METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

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Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods and Compositions

ESTABLISHED 1903

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

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California Growth Of Metal Finishing

The metal finishing industry in California was given a tremendous impetus during the war because of the need for large and small plating and processing plants to serve the heavy concentration of war plant production carried on there, particularly in airplanes, plane parts and machine tool output. During the two year interim since the close of the war there has been no abatement in this growth in California, and, defining it more specifically, in Southern California.

The present development of electroplating, polishing and its allied crafts assumes boom proportions, especially in the eleven southern counties of which Los Angeles is the hub. Statistics reflect this boom as follows: before the war there were approximately 100 factory plating departments and contract shops in this area, at the immediate close of the war there were 220 and at the present time over 300. Some of these are not yet in operation. Seventy-five per cent of all new plating installations on the West Coast are in the Los Angeles area. Practically every month METAL FINISHING publishes brief reports of five or six new plants that are being set up in the Los Angeles area. Those reports merely skim the surface of the tremendous activity that is taking place there. The new construction covers literally every phase of the industry in both the contract plants and large factory assembly-line installations.

Conservative estimates place the value of new plating plant construction and expansion of existing factories, including building and equipment, at approximately $1,000,000 since the first of the year in Los Angeles and immediate vicinity alone.

On the labor front, there still exists a decided shortage of competent plant personnel, which is perhaps most pronounced in polishing and buffing in the Los Angeles area. This situation obtains some relief from the continuous transfer of midwestern and eastern shop workers to California, but in late spring an experienced, reliable polisher and buffer was still a welcome visitor in most large plants, where the supply still had not been squared with the demand. The exodus in population from the eastern sections to the west coast among those engaged in the metal finishing industry is proportionately on a par with California's general population growth, which has resulted in an increase of more than 1,000,000 people in Los Angeles County alone since the last U. S. census, making Los Angeles fourth in size among the nation's cities.

American Electroplaters' Society National Convention and Industrial Finishing Exposition

MORE than one hundred nationally known manufacturers from all parts of the country will exhibit the latest equipment, materials, services, processes, and plated products at the Industrial Finishing Exposition. The Exposition will be held in Detroit, June 23-27 in conjunction with the American Electroplaters' Society Annual Convention.

One of the outstanding educational features of the Industrial Finishing Exposition will be a completely equipped plating installation where souvenirs will be plated and given to Exposition visitors. This plating plant will consist of full-scale plant equipment, and will be operated under normal plant conditions. It is believed that this particular exhibit will illustrate how plating procedures are conducted.

Fully automatic and semi-automatic plating processing machinery will be in operation in several booths. The exhibitors of this machinery will show full-scale production units.

Automatic polishing and buffing equipment will be in operation. In connection with this type of machinery, special emphasis will be laid on the application of buffing compounds. Both mechanical applicators and the latest spraying devices will be shown.

A graphic illustration of the largest plating installation in the world will be the feature of one important display. The complete operation of this huge plant will be shown in mural-style photographs and charts.

One of the most interesting developments to reach the electroplating industry in some time is the matter of generator control or "current reversal". This will be one of the feature attractions of a prominent display which will include recent developments in temperature, automatic fluid or solution level controls.

Most of the important generator and rectifier manufacturers will have their products on display, and representatives will be present to explain the details of each product.

The latest processes in copper and nickel baths; the new rust proofing solutions with their subsequent recent protective coating developments will be there for investigation.

For those interested in the protection of the "plating room tool", the plating rack, new rack coatings will be displayed, as will lacquers for special finishes.

New cleaning developments, degreaser equipment and applications, complete filter equipment and accessories will be there for examination.

Safety engineers will be particularly interested in seeing new methods and ideas for the handling of acids and other materials for safeguarding employees.

The Industrial Finishing Exposition is expected to be the mecca for A.E.S. members, process engineers and technicians, and all operating engineers and executives who will for the first time in over ten years have the opportunity of seeing, investigating, and discussing the up-to-date developments and ideas of the complete metal finishing industry.

For the membership of the American Electroplaters' Society, whose headquarters will be at the Statler Hotel, there will be additional features. One of these features of the 34th Annual Convention of the American Electroplaters' Society, will be the Society Branch exhibits which will be located at the Statler Hotel Convention Headquarters. All arrangements for these exhibits are being handled by Mr. Arthur Logozzo, Branch Exhibits Chairman, Supreme Third Vice President of the Society, who can be reached at his business address, the Nutmeg Chrome Corporation, 79 Chapel Street, Hartford, Conn.

The Society will hold five technical sessions, covering a wide range of subjects that are sure to be of vital interest to electro-chemists and engineers.

The various nationally known plants under consideration for plant visitation on Friday, June 27th, are:

Chevrolet Bumper Division, Detroit, Michigan
Cadillac Motor Division, Detroit, Michigan
Ford Motor Company, Detroit, Michigan
Fisher Body—Ternstedt Division, Detroit, Michigan
Pontiac Motor Division, Pontiac, Michigan
United States Rubber Company, Detroit, Michigan
Wyandotte Chemicals Corporation, Wyandotte, Michigan

Final arrangements will be detailed in the general program.

The Hooker Kresge Library located at Wayne University in Detroit, which was sponsored and equipped by the Detroit Branch of the A.E.S., will be open to all visitors wishing to avail themselves of the opportunity to examine the most complete library pertaining to the art of plating.

On the pleasure side, a full program of entertainment for the members and their wives has been arranged. Included in the plans are the Annual Good Fellowship luncheon and open house gathering in the evening of the opening day. Luncheons for the ladies including fashion shows have been arranged. One afternoon and evening will be given over to a

general outing for the members, wives and friends with luncheon aboard boat, a cooling trip down the river into the lake and dinner at famous Bob-Lo Island, returning in the evening. Dancing on the boat and island, golf at the island, and the Oneida Quartet to sing ballads are part of the entertainment program.

The Plating Institute and the Job and Contract Platers of Detroit will be hosts at luncheons and also conduct their Annual Luncheon and Dinner.

Requests for assistance of the Housing Committee, Jess E. Bunch, Chairman, must be received not later than June 1, 1947. Standard reservation forms have already been mailed to the A.E.S. membership; additional copies may be had by writing to the Housing Committee Chairman, Industrial Finishing Exposition, Convention Hall, 4484 Cass Ave., Detroit 1, Mich.

A partial list of the scheduled exhibitors is as follows:

Acme Manufacturing Co., Detroit, Mich.
Advance Plating Co. Inc., Detroit, Mich.
Advance Polishing Wheels Inc. (Matchless Metal Polish Co.) Chicago, Ill.
Aget-Detroit Co., Ann Arbor, Mich.
American Buff Co., Chicago, Ill.
American Instrument Co., Silver Spring, Md.
Auto City Plating Co., Detroit, Mich.
Automotive Rubber Co. Inc., Detroit, Mich.
Barwin Co., Oronoque, Conn.
Beacon Wiper Supply Co., Chelsea, Mass.
Belke Mfg. Co., Chicago, Ill.
Bruce Products Corp., Detroit, Mich.
Buckeye Products Co., Cincinnati, Ohio
Buckingham Products Co., Detroit, Mich.
The Chemical Corp., Springfield, Mass.
F. L. & J. C. Codman Co., Detroit and Rockland, Mass.
Commercial Filters Corp., Boston, Mass.
Crown Rheostat & Supply Co., Chicago, Ill.
Detrex Corp., Detroit, Mich.
Detroit Chemical Specialties Co., Detroit (Dearborn), Mich.
Detroit Plating Industries, Detroit, Mich.
Die Castings Magazine (Technical Publishing Co.), Cleveland, Ohio
Diversey Corp., Chicago, Ill.
Dunn Products, Chicago, Ill.
E. I. du Pont de Nemours & Co., Wilmington, Del.
Duriron Co., Inc., Dayton, Ohio
Eaton-Clark Co., Detroit, Mich.
Egyptian Lacquer Mfg. Co., Newark, N. J.
Electric Products Co., Cleveland, Ohio
Electro-Tech Equipment Co., New York, N. Y.
Federal Telephone and Radio Corp., Newark, N. J.
Formax Mfg. Co., Detroit, Mich.
Gate City Plating Works, Kansas City, Mo.
General Electric Co., Schenectady, N. Y.
Gerity-Michigan Die Casting Co., Adrian, Mich.
Frederick Gumm Chemical Co., Inc., Kearny, N. J.
General Chemical Co., New York, N. Y. and Ecorse, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harding Mfg. Co., Inc., Detroit, Mich.
Harshaw Chemical Co., Cleveland, Ohio
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Houdaille-Hershey Corp., Detroit, Mich.
M.P. Iding Disc Grinding Compound Co., Inc., Milwaukee, Wis.
Industrial Electroplating Co., (Niehaus Engineering), Indianapolis, Ind.
Industrial Filter & Pump Mfg. Co., Chicago, Ill.
International Nickel Co., Inc., New York, N. Y.
The Iron Age (Magazine), New York, N. Y.
Knight Plating Co., Detroit, Mich.
Lasalco Inc., St. Louis, Mo.
Lea Mfg. Co., Waterbury, Conn.
Maas & Waldstein Co., Newark, N. J.
MacDermid Inc., Waterbury, Conn.
R.C. Mahoney, Detroit, Mich.
Mall Tool Co., Chicago, Ill.
Manderscheid Co., Chicago, Ill.
McGean Chemical Co., Cleveland, Ohio
Meaker Co., Chicago, Ill.
Metal Finishing Magazine (Metal Industry Publishing Co.) New York, N. Y.
Michigan Abrasive Co., Detroit, Mich.
J. C. Miller Co., Grand Rapids, Mich.
Milwaukee Motive Mfg. Co., Milwaukee, Wis.
Murray-Way Corp., Detroit, Mich.
George L. Nankervis Co., Detroit, Mich.
Nelson Chemicals Corp. (Gripmaster Div.), Detroit, Mich.
Oakite Products, Inc., New York, N. Y.
Parker Rust Proof Co., Detroit, Mich.
Products Finishing Magazine, Cincinnati, Ohio
The Plating Institute (National Association of Metal Finishers, Inc.), Detroit, Mich.
Promat Div., Poor & Co., Waukegan, Ill.
James H. Rhodes & Co., Chicago, Ill.
Rusclan Co., Detroit, Mich.
Claude B. Schneible Co., Detroit, Mich.
J. J. Siefen Co., Detroit, Mich.
Solventol Chemical Products, Inc., Detroit, Mich.
Sparkler Mfg. Co., Mundelein, Ill.
Special Chemicals Corp., New York, N. Y.
Standard Electrical Tools Co., Cincinnati, Ohio
Standard Plating Rack Co., Chicago, Ill.
Frederic B. Stevens, Inc., Detroit, Mich.
Sturgis Products Co., Sturgis, Mich.
Sulphur Products Co., Inc.
Tanner Chemical Co., Detroit (Ferndale), Mich.
H. O. Trerice Co., Detroit, Mich.
Udylite Corp., Detroit, Mich.
United Chromium, Inc., New York, N. Y., Detroit, Mich.
United Platers Inc., Detroit, Mich.
U. S. Stoneware Co., Akron, Ohio
Wagner Bros., Inc., Detroit, Mich.
Waverly Petroleum Products Co., Philadelphia, Pa.
A. T. Wagner Co., Detroit, Mich.
Wico Metal Products Co., Van Dyke, Mich.
Wyandotte Chemicals Corp., Wyandotte, Mich.
Wyandotte Paint Products Co., Wyandotte, Mich.
Zapon Div., Atlas Powder Co., Wilmington, Del.

Practical Methods in Heavy Industrial Nickel Plating

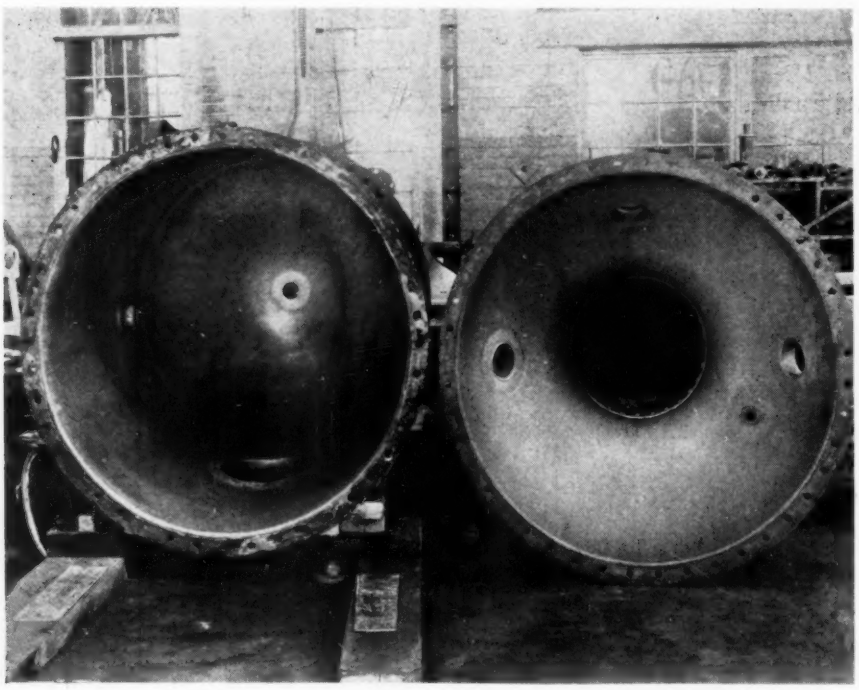
By E. J. Roehl, *Chemist, Research Laboratory, The International Nickel Co., Inc.*

THE first World War brought into prominence the possibilities of heavy electrodeposits for the repair of worn parts, the reclaiming of mismachined parts, and also the advantages of these deposits as original surfaces for wear and corrosion resistance in several applications. The recent war further emphasized this type of work and although during the intervening years between the wars heavy plating did not receive the attention from commercial plants that it deserved, many shops are now in operation for the production of heavy deposits, particularly chromium and to a lesser extent, nickel.

Since chromium is outstanding among the metals used in industrial plating, it is natural to use it as a standard when considering nickel. Comparison of the properties of the two metals illustrates the distinctive features of each, but, as in other plating fields they should be considered as naturally complementary rather than competitive. The most outstanding advantages of heavy chromium deposits, which make them most useful for wear resisting purposes, are their extreme hardness (400 to 950 Vickers) and low coefficient of friction. No data are available on the tensile strength and ductility of chromium deposits, but they are quite brittle and the ductility is probably very low. Metallic chromium, electrodeposited in pure form, has excellent corrosion resistance, but thin deposits contain a network of fine cracks; these are rapidly indicated in corroding media by local attack on the basis metal. By depositing chromium to a thickness of 0.003 inch or heavier, the cracks may be filled in and these heavy deposits are therefore useful for resisting many corrosives. Finishing of chromium deposits to size is accomplished by grinding, since the metal is too hard and brittle for machining.

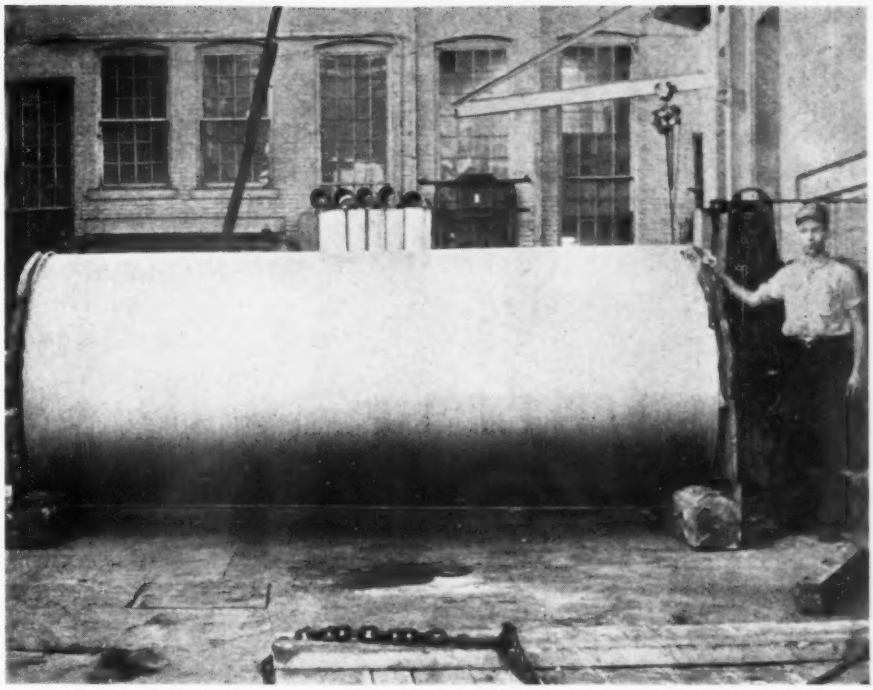
Physical Properties

The good corrosion resistance of nickel under a wide variety of conditions is one of its major advantages and accounts for its wide use in the chemical industry, and the same properties are present in materials which have been heavily nickel plated. Nickel may be deposited in a rather broad range of hardness, lying mainly below the hardness of chromium, but still extending up to the comparatively high value of 450 Vickers. Annealed nickel deposits may be as low as 63 Vickers. The greatest tensile strengths are of course found in the harder deposits while the ductility is greatest in the soft deposits, reaching a maximum elongation of about 50% in annealed nickel. The wide choice of mechanical properties which are available for engineering purposes is illustrated by the data in Table 1. While electrodeposited nickel cannot be expected to give the extreme wear resistance shown by many chromium deposits, nickel work hardens rapidly under sliding action and the wear resistance of relatively soft deposits will, under many conditions, equal that of deposits which were initially of higher hardness. When plated surfaces are to be subjected to



Vacuum pans used in processing tomatoes, 48 inch diameter by 74 inches deep. Inner walls nickel plated with 0.01 inch deposit.

Courtesy Union Screen Plate Co.



Paper mill sweat dry roll, 60 inch diameter by 156 inch face. Nickel plated to a thickness of 0.03 inches.

Courtesy Union Screen Plate Co.

pressure or hammering the hard nickel is preferred over the soft nickel.

While nickel electrodeposits may be ground to required finished dimensions, their machineability is advantageous for their use in reclaiming and repair work. Many parts are difficult to grind to a finish and certain broaching operations can be carried out with nickel which are not practical with chromium deposits. Inherently, nickel may be plated at higher speed than chromium, and a further advantage of nickel is its greater ability to deposit in recessed areas.

Nickel and chromium work as well together in heavy industrial plating as they do in decorative work. When steel or other basis metals are properly prepared, nickel deposits adhere perfectly and chromium is deposited as easily or easier on nickel than on steel. The tough, wear and corrosion resistant nickel may be used to rapidly build up the major portion of the deposit, and when this is then coated with a relatively thin deposit of the hard chromium a product with a long life expectancy is obtained.

Electrodeposition of nickel is carried out from a wide variety of baths and on a wide variety of basis metals. In industrial plating more powerful etching methods than those used for decorative work are employed, there is some interpenetration of the lattices and hence a strained condition, and the joint may be stronger than either basis metal or deposit. To obtain this type of adhesion the preparation of the basis metal must be carried out according to controlled procedures, and although these are not complicated or difficult it is necessary to warn the workman that certain rules must be followed without deviation to secure deposits which are thoroughly reliable from an engineering standpoint. The following paragraphs give in some detail the important features that must be considered in the nickel plating of steel for engineering uses.

Cleaning

Whenever possible the bulk of the degreasing should be done before a stop-off is applied; with wax stop-off this may not be necessary, but some lacquers soften in the alkaline cleaner (particularly if it is too hot) and tend to lift at the edges. Any practical method may be employed—vapor degreaser, pumice scrub, wiping with organic solvent—in conjunction with the usual cathodic alkaline cleaner treatment. The important point is to produce a clean surface.

Etching

For most work on steels and cast iron a solution containing 25% by weight of sulfuric acid (22 ozs./gal.) will be used. Lead electrodes are used and the tank should be connected through a reversing switch. The tank should preferably be fitted with a lead cooling coil as the temperature should not be allowed to rise over 77°F. After etching, the entire surface to be plated should be inspected; the surface should be a uniform gray color and free from defects or smut. The time between removal from the etching solution and immersion in the plating bath (including a thorough rinse) should be as short as possible—less than a minute. If the surface is not clean or if the inspection requires too long a time, the piece should be re-etched.

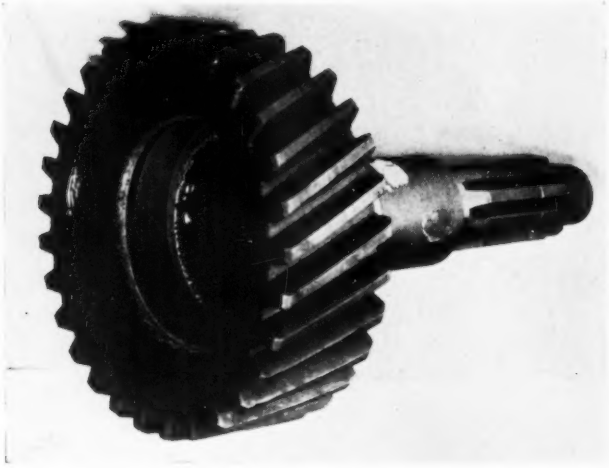
Parts should be put into the plating bath with the current connection made, and at a low current density (2-5 asf). This will prevent an initial abnormally high current density on the first portion of the part to enter the bath and will also aid adhesion; the current density is then adjusted to its predetermined value.

Adhesion[1]

Carbon and low alloy steels are treated anodically in the 25% sulfuric acid etching solution at 200 asf for five minutes after the vigorous gas evolution has started. If solid particles remain on the surface a short reversal (2-3 seconds) will usually clean it up. Copper should not be allowed to accumulate in this solution as it will deposit during cathodic treatment and produce non-adherent deposits.

Cast and wrought irons are treated in the same solution but at 100 asf.

Stainless steels are treated in a solution containing 240 gpl nickel chloride (32 ozs./gal.) and 36 gpl HCl (4.8 ozs./gal.). The part is made anodic for two minutes, then cathodic for six minutes, both at



Mismachined transmission gear nickel plated on inside diameter with 0.02 inch deposit.

30 asf, and is put into the nickel plating bath without a rinse.

High alloy steels are treated in the sulfuric acid solution and then made cathode in the acid chloride solution at 30 asf for six minutes.

If other than a momentary current interruption occurs a lamination will be produced, and the current should be stopped at once. If the piece is in the soft or chloride baths the part is made anode at 10 asf for three minutes; the current is then reversed and plating continued. If the part is in the hard bath it must be removed and given the following cycle in the 25% sulfuric acid solution: anodic at 20 asf for three minutes, current raised to 200 asf for five minutes, then reversed for 2-3 seconds.

An annealing treatment of two hours at 400°F will increase the adhesion; it may not be necessary for carbon or nickel steels, but should be employed for nickel-chromium-molybdenum alloy steels.

Deposition Rate

No precise value can be given as it will depend upon the shape, the presence of guards, shields, auxiliary anodes, etc. Nickel will be deposited at 0.001—0.004 inch per hour at 25-100 amps. per sq. ft., and the common values for chromium are .0004-.0008 inch per hour.

Plating Baths

Table 2 gives the compositions and working conditions for the three nickel baths. The lower current density values are to be used where the part has sharp edges, corners or other areas where the current density will be excessive; the higher values are for more uniform parts or where the cathode is rotated. The ability of the soft bath to deposit uniformly over irregularly shaped parts is less than that of either the chloride or hard baths; the choice between the chloride and hard baths can only be made under experimental conditions with the particular part. The chloride is the best solution for general use; the deposits are smooth even at thicknesses of 0.05 inch or more, there is less treeing and build-up at corners and edges, higher current densities can be used, and the deposit is tough and relatively hard and ductile. The mixed sulfate-chloride bath of Pinner & Kinneman[2] has been used for heavy plating and has proved very satisfactory. It retains the advantages of the chloride and soft baths and the deposit properties are probably intermediate.

Anti-Pitting Agents

Hydrogen peroxide (30%) in quantities of 0.4 ml. per liter (5 ozs./100 gals.) are used every 24 hours, the peroxide should not contain organic stabilizers. Wetting agents are also used and a reduction of surface tension to about 45 dynes per cm. is apparently sufficient; pitting may develop after a time although the surface tension is at the correct value, in which case a treatment with activated carbon is necessary. Peroxide and wetting agents should not be used at the same time.

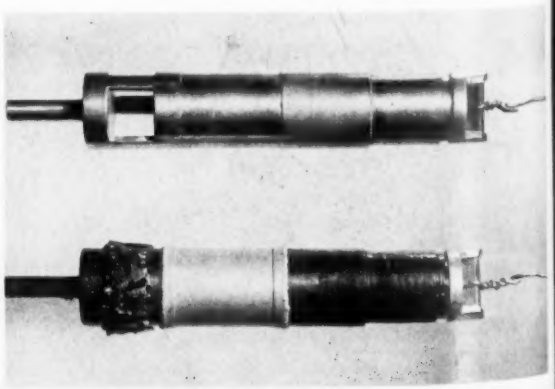
Nickel plated crankshaft, 0.01 inch deposit.

Bath Purity

It is very important that the solutions be maintained in a pure state; activated carbon and clay treatments, oxidation with excess hydrogen peroxide[4] and low current density working of the bath[5], are the common procedures[6]. Anode bags and frequent, if not continuous, filtration are essential for heavy nickel plating.

Metal Distribution Control

In preparing mismachined or worn parts for plating the surface finish is not too critical and the usual finish from the machine shop is satisfactory. Whenever possible sharp edges and corners should be rounded off and angles should be filleted. A careful



Mismachined stainless steel valves nickel plated with 0.015 inch deposit.

TABLE 1

MECHANICAL PROPERTIES OF NICKEL DEPOSITS

	Watts—Soft		*Chloride*		*Hard**
	As Plated	*Annealed*	*As Plated*	*Annealed*	*As Plated*
Tensile strength, psi	63,000	50,000	100,000	58,000	156,000
Elongation, % in 1"	31	50	21	48	6
Vickers Hardness Number	137	63	240	81	400
Rockwell Hardness Number	75(B)	17(B)	99(B)	36(B)	
			20(C)		42(C)

Anneal: 15 Minutes at 1400°F.

*To retain the initial hardness value, hard deposits should not be heated above 500°F.

TABLE 2

BATH COMPOSITIONS

	Watts—Soft	*Bath Chloride**	*Hard***
Nickel sulfate, gms./liter	330 (44 oz./gal.)	—	180 (24 oz./gal.)
Nickel chloride, gms./liter	45 (6 oz./gal.)	300 (40 oz./gal.)	—
Boric acid, gms./liter	30 (4 oz./gal.)	30 (4 oz./gal.)	30 (4 oz./gal.)
Ammonium chloride, gms./liter	—	—	25 (3.3 oz./gal.)
pH	2	2	5.8
Temp., °F	140	140	130
Current density, asf	50-100	50-100	40-75

*Wesley and Carey: Trans. Electrochem. Soc. *75*, 179 (1939).

**Wesley and Roehl: ibid. *82*, 37 (1942).

consideration of the shape of the part to be plated will be necessary and will warrant the time spent, but only actual experience will indicate the proper placing of thieves at edges and corners and the use of insulating shields and auxiliary anodes; the auxiliary anodes are usually connected through a separate circuit to control the current density. It is desirable to alter any set-up frequently during the plating operation, either by shifting the anodes or by rotating the part. Gas bubbles must be dislodged from undersurfaces with rubber gloves, rubber-covered rods, etc.

Toward the end of the plating period the work should be sized, and in some cases this can be done in the bath with clean calipers without interrupting the plating current.

Parts are normally overplated, then machined to size; and the amount of overplating is based on the recessed areas which receive the smallest portion of the deposit.

Machining

High speed tool steels are necessary, and the 18-14-1 tungsten steel containing high cobalt and low molybdenum is satisfactory. The tool is set 1/64 to 1/32 inch below center with a 70° cutting angle and all clearances 10°. The cut should begin at the center of the part to prevent chipping of the heavier deposit at edges and corners. A lubricant is advisable. Some parts are more economically finished to size by grinding. Too drastic a cut in one operation should be avoided to prevent overheating of the deposit with consequent reduction in hardness. The deposits can be milled but shaping or planing is not advisable due to the effect on the edges.

Applications

The decision as to whether a worn or mismachined part should be recovered by plating will be based on its initial cost or its availability, but another factor may be more important; it is often the case that a plated part shows a longer life than the original part and there are many instances where new parts are finished by plating for this reason.

The following list indicates actual or suggested applications of heavy nickel plating, primarily for corrosion and abrasion resistance: Sucker rods for oil wells, hopper jaws, tubing and fittings plated on the inside diameter (soap, food, petroleum industries, pulp lines for paper mills, boiler tubes, feed water and caustic lines), pump rods and plungers, ball mills, printing cylinders, plug cocks, lehr rolls, tubing plated on outside diameter, drum plugs, food processing equipment, turbine blades and buckets, molds, press plates.

Applications for improving new parts and the salvaging of mismachined or worn parts comprise the following list: Pump sleeves, shaft rods and plungers; large rolls for various types of service—embossing rolls for paper mills, for acetate strip, film drying drums; hydraulic rams; armature and cam shafts; bearings; numerous applications for bus, truck, railroad, machine shop and mine equipment; also in marine engineering and in the aircraft industry.

There is no simple answer to the question—where

(*Concluded on page 71*)

Electropolishing Silver to Reduce Finishing Costs

By Daniel Gray, *Oneida, Ltd., Oneida, N. Y. and* S. E. Eaton, *Arthur D. Little, Inc., Cambridge, Mass.*

A NEW electropolishing process* developed for a firm of silver flatware and hollow ware makers has greatly simplified finishing operations for their various products.

The expensive hand buffing operation (Fig. 1) ordinarily required to bring electrodeposited silver to a satisfactory smoothness and luster is reduced to a minimum. In some cases this operation is entirely eliminated and the electropolished articles go directly to the light final buff used to give the desired finish or "patine" to the surface (Fig. 2). Minimizing the primary buffing operation results in considerable saving in labor, buffing compounds and wheels. When it is eliminated, the cost of finishing a typical article may be reduced by fifty per cent.

The quality of articles is also improved by this process. Primary rouge buffing removes about 5% of the silver deposit. Unfortunately this is not removed evenly from the surface. In trying to buff less accessible areas of an article undue pressure may be brought to bear on other parts, particularly edges. This may result in the removal (called "line stripping") of the entire deposit on edges or corners.

* Developed at laboratories of Arthur D. Little, Inc., under sponsorship of Oneida, Ltd.

Fig. 1. Buffing operation now replaced by electropolishing.

Electropolishing on the other hand removes about 1% to 2% of the deposit, much more evenly than buffing. Consequently, line stripping is reduced and the finished articles have more silver left on them than when buffed.

Method Used

Electropolishing in general is a relatively new finishing technique in which the article to be polished

Fig. 2. Light final buff now used after electropolishing to produce special finishes desired by the trade.

is immersed in a suitable bath and electric current is passed in the opposite direction to that employed in ordinary electroplating. The high spots of the metal surface dissolve preferentially to produce a smooth mirror finish. Development in the past ten years has been rapid and many electropolishing processes are now in use, particularly for stainless steel. Most of them use strongly acid baths.

The present process on the other hand uses an alkaline cyanide bath. There are several variations of this cyanide process, each suited to specific needs. One variation has been in satisfactory commercial use in Oneida, N. Y., for the past year and a half and is well suited for electrodeposits of about .002" or less. It is also flexible and easily tailored to suit widely varying needs. This is evidenced by the fact that it was installed on pre-war automatic plating machines designed before electropolishing was con-

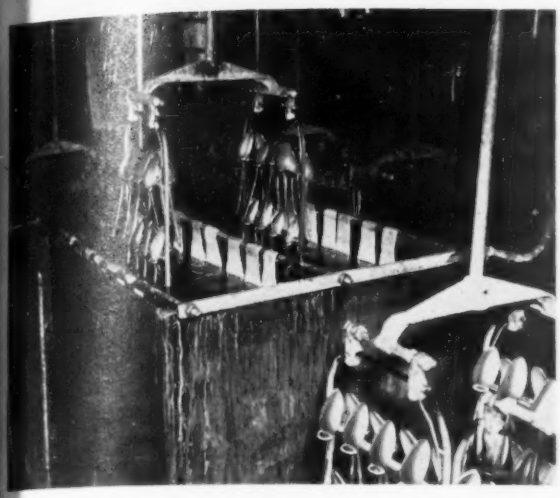


Fig. 3. Electropolishing bath at Oneida.

ceived. Like all of the variations, this one involves the use of reverse current, properly controlled.

Spoons, forks and other articles are mounted in the usual manner in racks and plated with silver in a typical cyanide bath. The racks are lifted automatically from the plating bath. They then pass over a drip-pan, following which they go into the electropolishing bath, without any intermediate rinse. Fig. 3 shows the installation, with a rack of work and the electropolishing solution.

The details of the process are simple. The solution itself is essentially a silver cyanide plating bath. The composition is roughly:

Silver: 4 to 6 oz. Troy metallic Ag per gallon, added as K Ag $(CN)_2$

Potassium Cyanide: 4 to 5 oz. Avoir. per gallon

Potassium Carbonate: 6 to 8 oz. Avoir. per gallon.

About 5 volts D. C. potential at the source is applied, with the work to be polished as anode. The voltage across the cell itself varies from 2.7 to 3.5 volts, depending on the area of the work. The cathodes are silver. Although the ratio of electrode areas is not critical, a ratio of 1:2 anode to cathode is desirable

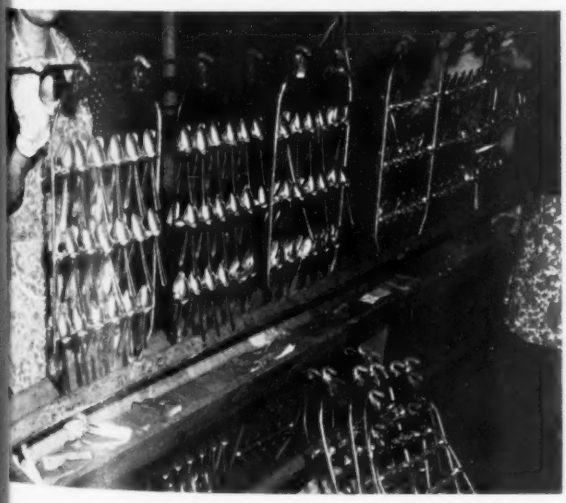


Fig. 4. Spoons drying after electropolishing. Note greater luster on work which has dried (right).

to prevent the formation of a spongy deposit. Incidentally, the silver removed from the work is recovered as pure silver deposited on the cathodes. The saving in refining charges is considerable as compared to recovery from buffing dust. The current required varies from 12 to 18 amperes per square foot, which is near the normal plating range. The polishing time is 15 to 20 seconds, depending on the speed of the machine. While being polished the work is moved through the bath about ten inches by a screw conveyor.

Fig. 4 shows work which has been plated and electropolished. It should be noted that the full luster is apparent only when the work is thoroughly dry.

The great flexibility of this process may be

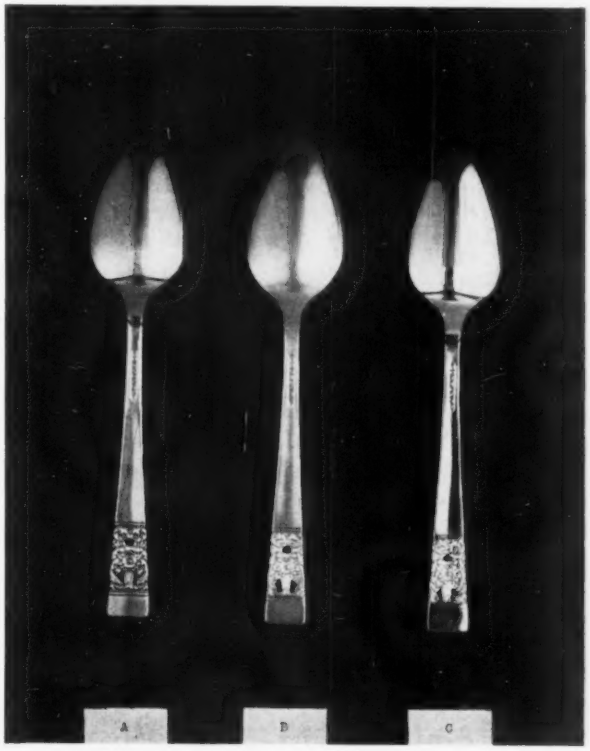


Fig. 5. (A) Buffed and colored in conventional manner.
(B) Ordinary silver plate, direct from bath.
(C) Electropolished, no after treatment.

ascribed to the simplicity of control. Solution composition, voltage (or current), agitation and time are the vital factors. By varying one or more of these factors it is possible to produce a mirror finish in from four to sixty seconds. Obviously any desired amount of silver may be removed. The electrical efficiency of both anode and cathode is about 100%. The amount of drag-out liquid adhering to the surface of the work is the main cause of change in composition. Since the viscosity is low, drag-out is low, and the solution can be maintained easily by analysis and additions. Where brightness of the article is the sole requisite, no finishing is needed; however, in this application brightness is secondary to smoothness for the purpose of final finishing. Fig. 5 shows a conventional buff-finished spoon with the marks of the abrasive buffing operation, a spoon as plated and an electropolished spoon. It will be observed that

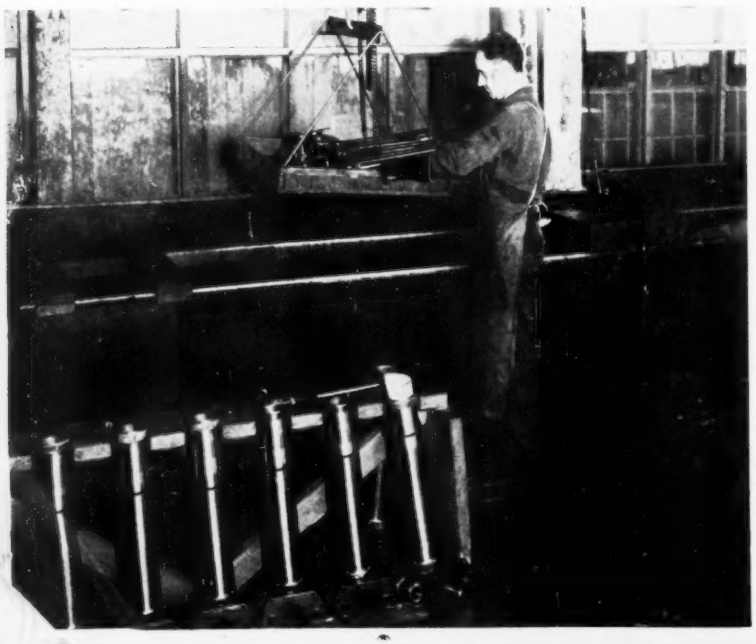
(*Concluded on page 65*)

Application of Metallic Coatings

By Rick Mansell, *Los Angeles, Calif.*

A survey is made of corrosion, cleaning and pickling, polishing methods and electrodeposition processes in metallic coatings. The work is presented with the viewpoint of supplying the reader with a basic framework on these subjects to which further information can be added; the author attempts to present the work in a form capable of rapid assimilation.—Ed.

GENERALLY speaking, coatings are applied to surfaces either to make them more attractive to the eye or to preserve them from the attack of the environment in which they are placed. As far as metals are concerned the name given to this attack is corrosion. Metals corrode as a result of a chemical reaction with certain non-metallic elements that exist in their surroundings. Corrosion may result as a direct combination of the metal with non-metals, as is indicated in the process of oxidation, in which it combines with oxygen; in the process of halogenation in which it combines with halogens such as chlorine; or in sulfurization reactions in which it combines with sulphur. However, most of the more common practical problems of corrosion are concerned with those types of reactions in which the corroding metal replaces hydrogen from water or acids; this has been found to be an electrolytic process and occurs in the presence of moisture. In the following few paragraphs we shall concern ourselves with a short summary of the theory involved.



Left, cleaning by tank immersion. Note method of racking parts for moving.

Corrosion

When a metal exists in an environment containing moisture, there are two reactions which occur at the same time on its surface. Both of these processes are a result of ionization. This is the name given to the splitting of a molecule into ions when a substance is dissolved in water; the theory of ionization was put forward to explain the difference in the behavior of a substance when dissolved in aqueous solutions as compared with its behaviour when dissolved in non-aqueous solutions. It was Michael Faraday who first used the word ion, which is a Greek word spelled in Latin letters and means wanderer or traveller. Incidentally, Faraday's idea was that electricity entered a solution at the positive pole and passed down to the negative pole. His term anode means up a path and cathode means down a path; the two electrodes were considered as doors or paths by which the current entered and passed out of the solution.

Thus on the surface of the metal, the two reactions which take place are its own ions passing into solution and hydrogen ions passing out of solution to form hydrogen gas. Hence there are two kinds of areas: an area at which metal is dissolved and an area at which hydrogen ions are discharged (or combined with oxygen to form water). If a given surface of a metal were entirely the same nature everywhere, i.e., if it were completely homogenous, then there would be no reason or basis for the selection and establishment of two kinds of area. It has been well recognized that a metal which is spectroscopically pure will resist entering into solution even in the presence of acids; this is due to the uniformity or homogenity of the interface between the metal and the acid and not to a decreased internal tendency of the metal to dissolve.

Most metal surfaces in industry are not uniform but contain areas which are chemically and physically different from the remainder. They have present metallic impurities, oxides; there are differences in crystal structure and there is physical strain present as well. All these lead to differences in the tendencies of the metal to go into solution. It is found that these areas

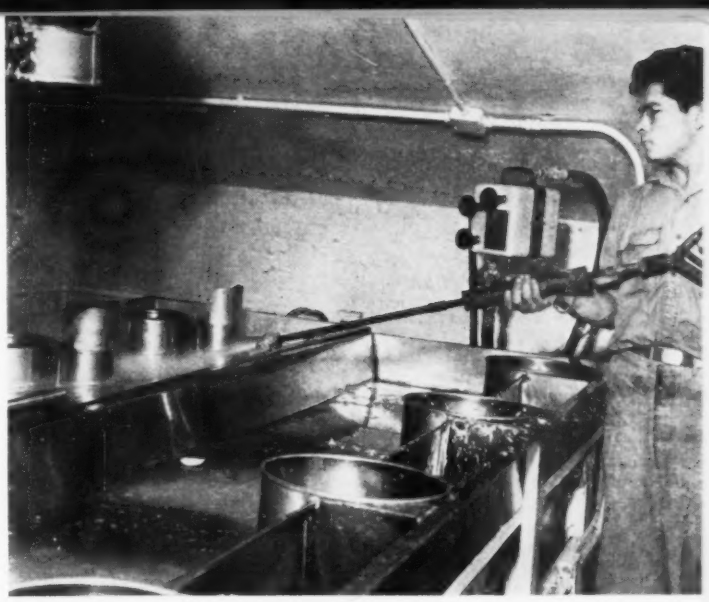
of different solution tendencies also possess different electrolytic potentials; here we have the basis for a galvanic cell. Those areas which are in favor of the solution of the metal constitute the anodes and those areas which favor hydrogen ion discharge are the cathodes. The quantity of the current which passes through these cells is proportional to the amount of metal which dissolves. It is the existence of this couple action which provides the mechanism by which the corrosion takes place. When we consider the whole subject of corrosion from the electrochemical standpoint we shall find that the basis is the electromotive force series. This is an arrangement of all the elements in the order of their tendency to go into solution.

There is always a thin film of moisture deposited on a metal surface. By a process of corrosion we first get a saturated solution of the metal hydroxide. When this evaporates we get a film of dry hydroxide or oxide which is deposited as a coating on the surface of the metal. This coating is resistant to water and will tend to render the surface of the metal passive or noble. The corrosion product of chromium is of such a nature as not to mar its reflectivity. Chromium does not readily corrode in the accustomed way because it has already had its surface converted to a film of a very uniform nature by a process of oxidation, which has already produced on its surface a passive film of chromium oxide. This probably consists of a continuous layer of closely packed chromic oxide with each molecule so arranged that the oxygen end of it is on the outside.

If the coating on the surface is continuous then the behavior will be just the same as the coating in the solid form, but whenever the coating contains discontinuities or developes pores, a galvanic couple of dissimilar metals is obtained. In the case of zinc coatings on iron or steel the coating metal is the anodic member of the couple, while in the case of copper or lead the coating metal is the cathodic partner.

The anodic type of coatings protect the base metal by changing any exposed areas of it from anodes to cathodes; in this process the coating metal itself is sacrificed by its own dissolution. However the portion of the exposed base metal most remote from the disappearing coating will begin to corrode; this is because there is a limit to the area which can receive protection in this way; beyond this limit we find that local corrosion cells begin to function and to reign supreme. Cathodic coatings will show pinhole corrosion, with each pore becoming a pit which begins to penetrate and may in due course perforate down to the base metal. Thus in these cathodic coatings it is essential that extreme care be taken to ensure that a non-porous metal layer is secured. When this is done full advantage can be obtained of its corrosion resistant properties, unhampered by formation of galvanic couples with the base metal.

A little earlier we referred to the resistivity of chromium resulting from the formation of chromic oxide on its surface. This is a naturally formed protective coating as a result of the reaction of the metal with air. An analogous example is the protective film formed inside circulating water systems when soluble chromates are added to the water used. Another way



Hydrosteam cleaning unit embodying chemical and mechanical cleaning principles.

of producing self formed protective films is by adding some agent to the metal itself which will promote this action; examples of this are the use of chromium and nickel additions to alloy steels; or the use of tin in Admiralty metal. Again the relatively good corrosion resistance of all the common nonferrous metals is due to the nature of the self formed surface films that these metals produce in ordinary environments. These particular surface films have the advantage of being held to the base metal by atomic forces. In addition they are usually very continuous although invisible; they are also impermeable and of low solubility; this helps the protective properties a great deal.

Decorative Coatings

Apart from the protective properties to enhance durability, metals have to be attractive and so the added coatings to metal cover a wide variety of types. Organic coatings such as paints, lacquers, synthetics, oils, waxes and bitumens are used; all of which act as a physical barrier to exclude the corrosive element in the environment. All of these organic coatings vary in their degree of impermeability, for moisture and oxygen do actually permeate them in varying degrees; it is therefore necessary that the surface of the base metal be rendered passive by a surface pretreatment of the bonderizing type or by the introduction of inhibitive pigments into the coating itself, as for example, zinc chromate and red lead. Apart from the organic coatings are the inorganic coatings of the type of vitreous enamels, as well as cement, concrete and clay products. Finally, the inorganic coatings of the metallic variety which employ almost all of the nonferrous metals except the alkali and alkaline earths are used. It is this latter type of inorganic coatings which forms the subject of this survey.

The process of coating base metals with gold and silver is an art of great antiquity; the base metals were heated and the noble metals were hammered on to them. The coating of sheet iron by hot dipping in tin was begun in 1600. The process of galvanizing dates back from 1740. The production of Sheffield plate by fusing sheet silver on copper or brass was begun in

1743 (modern examples of this process are cladding and fusion welding). Dip gilding or immersion plating of silver, gold, or platinum, on base metals, were followed by commercial electrodeposition or electroplating by the use of the electric current, in 1840. The processes of applying metallic coatings by cementation, spraying and cladding are the developments of the present century. In all of these processes their success will depend to varying degrees on the surface preparation of the base metal. It takes long experience to determine the exact rigidity of cleaning to suit the coating process involved. It is therefore highly important to understand the types of surface treatments of the base metal that are available. As this surface preparation is the key to success we propose to spend some time on its consideration before giving a concluding survey of the actual processes of metal coating.

Plating Preparation

The preparation for plating is just as important as the plating process itself. The article must be thoroughly cleaned from any foreign materials adhering to the surface. These may fall into two broad categories. First, materials of the class of oxides or their related products of corrosive influence such as scale, tarnish and rust; second the organic substances such as grease, oil and dirt. It is found that metal parts entering the finishing room are nearly always contaminated with grease contained in the slushing compounds which are employed as a means of temporary protection during storage and with cutting and buffing compounds which are used in drawing, machining, threading, and surfacing operations. In certain cases lubricating oils and greases together with soot and dirt which will constitute the principal type of surface pollution are present. The oily substances may be animal or vegetable fats which are saponifiable or they may be mineral oils which are unsaponifiable. Saponifiable materials are removed by alkalies while the unsaponifiable materials are emulsified with soaps and soap substitutes; these have the power of reducing the surface tension of the water, examples of which are the alkali salts of sulphonated naphthalene or higher alcohols.

Mineral oils and greases are best removed by solvents; these will be able to remove the loosely held solid dirt particles. Whenever we encounter heavy contaminations of grease and oil and solid dirt, it is found that emulsifiable solvent cleaners are very effective and economical. These are generally used by simply immersing the articles to be cleaned at room temperature; or alternatively by means of a forced spray followed by a hot water dip or spray. If an attempt is made to remove mineral oil in an alkaline solution, it will probably be found floating on the surface of the tank, just in the right position for recoating the articles as they are withdrawn. This explains why detergents or emulsifiers are so necessary for mineral oil contaminations. Corrosion products are removed by mechanical abrasion or by acid pickling. Rough surfaces are treated mechanically by sandblasting, steel wire brushing or by grinding and cutting down with abrasives. Pickling will also remove some of the roughness. To get efficient pickling, all of the grease and oil should be removed first; this will enable the work to get uniform action.

A mechanically clean surface is one in which there is no oil, grease, and solid particle dirt, while a chemically clean surface must in addition to these be free from chemical reaction products. To be considered clean a metal surface must wet and retain water without a break in the water film. Sometimes this condition may be fulfilled and yet still trouble may occur in the adhesion of the plated deposit. In this case it is necessary to recheck by immersion in a suitable dilute acid after the alkaline cleaner. If the surface of the metal does not wet following the acid dip, it proves that the alkaline solution treatment has left behind a deposit of a substance in the pores of the metal which is difficult to rinse off.

When organic coatings are applied to metals a physically clean surface is usually sufficient to produce adequate bonding, but surfaces prior to plating have to be chemically clean as well. The plater usually removes the oils by a solvent degreasing process followed by alkaline cleaning or pickling or both. The metal to be plated is then polished and buffed after it has been made physically clean; the compounds left on the work are removed by degreasing. The metal is finally chemically cleaned prior to plating. It is considered good practice to arrange the production schedule so that the metal is cleaned immediately after the buffing operation; this will prevent the formation of insoluble metallic soaps which generally occur in the interval after buffing. If circumstances do not permit immediate plating, there are available materials which permit the buffed metal to be cleaned and then rust inhibited with a water soluble film which will enable the work to be held over prior to plating.

Brass is more effectively cleaned, especially following the buffing operation, by electrolytic (cathodic) cleaning. There are on the market several well compounded soak cleaners which will meet the requirements for copper alloys. Forced spray or any other impingement method of cleaning is more effective than the use of still baths. Aluminum and its alloys are degreased in a solvent degreaser followed by specially compounded alkaline cleaners. When working with aluminum, care should be taken not to use too high temperatures or too strong solutions because of the danger of badly etched surfaces. The alkaline cleaners used for aluminum also tend to remove oxides as well, but it is better to use the acid type deoxidizing solutions which are on the market and which are more effective for the removal of oxides (these are used as a pretreatment prior to spot welding). In the cleaning of steel care should be taken following the cleaning cycle to prevent subsequent oxidation; the work is kept wet by storing in cold running water. It is found that zinc die castings often require scouring action cleaning procedures or an electrolytic cleaning method. The electroplater has always had a difficult time in getting effective surface preparation, but the experience of the last five years under war time conditions has been responsible for a great deal of information being placed at his disposal. In order that the entire surface may be plated, it is necessary that the electric current pass through every portion of the surface as

it makes contact with the plating solution. He has found that cleaning methods have to be arranged to suit his particular conditions; these include the quality of plating which is required, the time and equipment available for cleaning, and the amount of man power he has at his disposal.

The various methods in use for surface cleaning are considered next. These include vapor degreasing, alkaline cleaning, electrolytic cleaning, pickling, electrolytic pickling, mechanical methods, and finally electropolishing.

In vapor degreasing, solvents are heated until they vaporize; then they condense on cold parts of the work to be cleaned. The solvents dissolve the oil and the grease; and the flowing action tends to wash any solid particles into the boiler. The solvent which evaporates off is clean and the dirt and grease is left behind in the boiler; all this sludge is periodically removed from the boiler. The solvents used are either modified trichlorethylene or perchlorethylene. Vapor degreasers permit the handling of a large volume of work in a piece of equipment which requires little floor space. While vapor degreasing will remove oil and grease it will not remove entrenched solid particles and therefore additional treatment is usually necessary. Vapor degreasing is well adapted to automatic operations. The equipment consists essentially of a heating chamber for the liquid, a vapor compartment in which the work is cleaned, and a condenser in the form of cooling coils for controlling the vapor level in the apparatus. In many cases, provision is made to enable the work to be immersed in the liquid solvent before exposure to the vapors. A three dip trichlorethylene degreaser is very popular. The work passes on suitable conveyers into the boiling solvent where most of the grease present is removed: it then goes into a chamber of cold purified solvent: and finally through the vapor itself. The condensate from the condenser is fed back into a reservoir, which supplies the chambers with liquid solvent. The speed of the conveyor is from six to eight feet per minute. Where a conveyor operation is not justified, the work may be hand dipped using baskets or racks.

Alkaline cleaning utilizes a hot tank containing a water solution of an alkaline cleaning compound; but to avoid contamination of this tank it is necessary to use a precleaning method to remove excess of oil, grease and dirt. Emulsion cleaners are used for this purpose; these are chemicals which when added to solvents have the property of increasing the emulsifying, wetting and penetrating properties of the solvent; in addition they render the loosened dirt freely rinsable in water. A wide range of emulsion cleaners are on the market, ranging from those used for quick removal of oils and greases to those for the removal of baked-on carbon in engines. Emulsion precleaning is followed by immersion in a hot alkaline cleaning solution. For cleaning aluminum, chemicals of the type of caustic soda are dangerous; the latest aluminum cleaners have a sufficiently high degree of alkalinity for effective cleaning but are inhibited against attack on the aluminum; they are also free in rinsing properties. For cleaning steel a maximum degree of active alkalinity is made available to provide a full quota of cleaning energy. Water conditioning is provided to prevent the deposition of hard water film on the work. Wetting agents are added to bring the cleaning solution into intimate contact with the dirty surface and to enable it to penetrate the dirt. Again there must be a good emulsifying action to disperse oil and grease, a saponifying action to dispose of fatty acids, a deflocculating action to dispose of solid particles and a buffering action to prolong the life of the cleaning solution.

(To be concluded next month)

ELECTROPOLISHING SILVER TO REDUCE FINISHING COSTS

(Concluded from page 61)

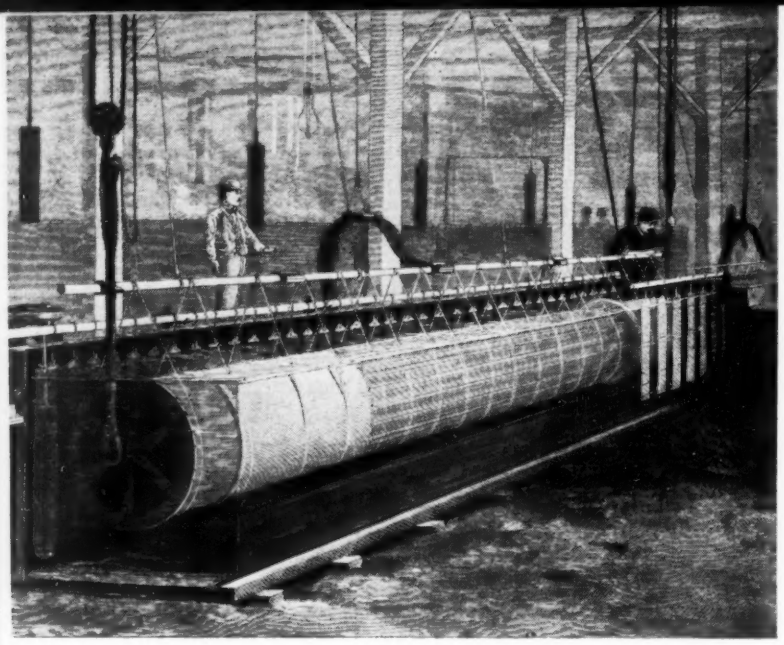
the electropolished spoon is much the brightest of the three.

Conclusion

Although this method of electropolishing with an alkaline cyanide bath has been applied on a full commercial scale only to silver, it is suitable for many other metals. Silver, cadmium, copper and alloys of these metals such as sterling silver and brass have all been polished successfully in the laboratory. Commercial applications, to meet specific needs, must be specially tailored to secure optimum results. This is best done in a semi-commercial unit such as that shown in Fig. 6.

A patent (U. S. No. 2,416,294) has recently been granted on this electropolishing process and others are pending. Oneida, Ltd., holds rights to the electropolishing of silver, and consideration is being given to licensing of other silver processors as soon as certain controls for the process have been worked out. Arthur D. Little, Inc., is continuing the development in fields other than silver.

Fig. 6. Semi-commercial plating and electropolishing equipment at Oneida.



Cross-sectional view of plating tank with a 26-foot long 3-ft. diameter column being electroplated. Note method of completing the cathodic circuit.

Aluminum Electroplating in America

Although formulas and operating instructions are not given, this paper explains the process involved in plating aluminum on cast iron columns and other large parts of the City Hall in Philadelphia 55 years ago. The article, together with illustrations, is reprinted just as it appeared in the Scientific American of October 22, 1892.—Ed.

THE tower surmounting the new City Hall of Philadelphia is 547 feet 3½ inches high. A part of this height is stone and the remainder of cast iron with wrought iron bracing.

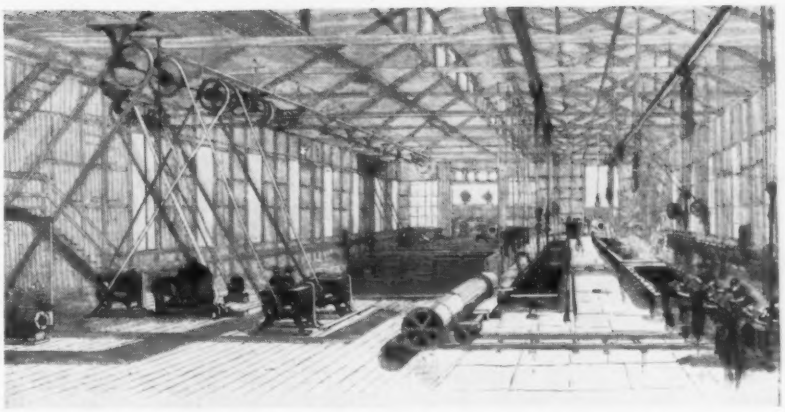
Mr. MacArthur, the architect of the public buildings, fully appreciated the difficulty and expense involved in keeping the iron work painted and free from rust. It was estimated that it would cost $10,000 per annum. He proposed to make the outer skin of aluminum, but the high cost of that metal prevented its use, and the clock story, which is the beginning of the iron work, was cast in iron, and to preserve it from rusting it was intended to dip the different pieces in boiling linseed oil. When, on the death of Mr. MacArthur, Mr. John Ord succeeded him as architect, the latter suggested that the iron work should be electroplated with aluminum to keep it from rusting, and after fully considering the matter it was determined to first plate the iron with a thick coat of copper, which, by experience, it was known would protect iron, and then put a finishing coat of aluminum over the copper so as to make it harmonize with the rest of the tower, and prevent the copper from turning green and becoming unsightly.

In the fall of 1891 at the works of the Tacony Iron and Metal Company, Tacony, Pa., which had the contract for the iron work of the tower, the construction of a building 120 feet long by 60 feet wide was begun under the supervision of the president of the company and was finished early in 1892. Mr. J. D. Darling of New York, had been appointed manager of the new plating works, and it was determined to use his process for plating with aluminum. By April, 1892, the huge tanks had been put in place, the electrical installation completed, and the different solutions to be used in plating made and run into the tanks. The plant was then ready to begin.

The size of the largest castings determined that of the tanks. These were the columns and pilasters that surround the clock story. They are 26 feet long by 3 feet in diameter at the lower end. Therefore the tanks were made 28 feet long by 4 feet wide, by 5 feet deep, and hold about 3,800 gallons when filled to the proper height. (The aluminum solution tank was made 8 feet deep for special work and holds 7,000 gallons.) The tanks rest in cement pits in two parallel rows of three each, as shown in the illustration, and

when the solutions were run in, water was admitted into the pits at the same time. The object of this was twofold—the water on the outside of the tank keeps it from leaking and also balances the hydrostatic pressure of the liquid within and prevents bulging. Over the centre of each row of tanks are I beams properly supported from the girders, and continuing for 30 feet outside of the building, on which run trolleys with differential hoisting blocks attached. To the two ends of the column or pilaster spiders with a central projecting trunnion are fitted by means of set screws, and wrought iron slings with a bearing on one end are hooked to the tackle, and the end containing the brass bearing is passed over the trunnion. The column when hoisted is thus free to turn on its axis. The operation of plating a column is as follows: The column is placed on a truck resting on a narrow gauge track, of which there are two running into the plating shop. It is then run under the projecting I beam, and, the slings being adjusted, it is hoisted clear of the truck. By means of a windlass fastened to the side of the building and ropes running over guide pulleys, it is then pulled along the I beam over the first tank, which is of iron and contains a strong solution of caustic soda heated by a steam coil; it is lowered in and boiled for several hours until all the grease and oil is dissolved off. It is then raised and, after thorough washing with water from a hose, pulled over and lowered into the second tank and pickled with dilute sulphuric acid until all the rust and scale are dissolved and loosened.

The column is then taken to the end of the building and thoroughly cleaned by the vigorous use of steel brushes and plenty of water. It then receives its first coat of copper in the third tank, which contains a cyanide plating solution. When the metal is coated with copper it is removed from the bath, and any holes are soldered, the copper giving a good ground for the solder to adhere to. From there it is transferred to the second row of tanks and, after having been coated with paraffine wax inside, lowered into the fourth tank, which contains an ordinary acid copperplating solution. There it receives a heavy coat of copper (about 16 ounces to the square foot of surface); then, after having the paraffine boiled off, it enters the fifth or aluminum tank, and after receiving a heavy deposit of aluminum, 2 to 3 ounces to the square foot, is washed with pure water in the sixth tank and run out of the building and placed on a truck on the other track ready for removal. There are also two smaller tanks for plating small work, shown to the left in the illustration. The total amount of surface plated was about 100,000 square feet. The plating current was furnished by four dynamos, the largest of their kind ever built in the country for purely electroplating purposes, through copper conductors 6 inches wide by half an inch thick, which run underground and alongside the different tanks. These are insulated there with resin run in while



General view of plating plant showing dynamos on left and tanks for cleaning and plating cyanide copper, acid copper and aluminum on the right.

melted. The dynamo shown to the left feeds the alkaline copper tank and develops 1,000 amperes at a pressure of 6 volts. The middle one develops 2,000 amperes at 8 volts and furnishes current for the aluminum tanks. The two to the right are coupled together and develop 4,000 amperes at 2½ volts, which feeds the acid copper tanks.

The columns and other pieces are brought into the electric circuit by wires passed around them like slings, and attached at the ends to a conducting brass bar over the tanks.

In the cyanide tank a current density of 3 amperes to the square foot is employed; in the acid tank 10 amperes, and in the aluminum tank 8 amperes.

As it is often asserted that aluminum cannot be deposited from an aqueous solution, the following information furnished by Mr. Darling is of interest: Although aluminum is generally credited with indestructible qualities, and high resistance to corrosion, it has but few qualities that would make it advantageous as an electro-deposit upon other metals; for while it resists atmospheric action when in a massive state, and retains a certain brightness for a long time, when it is deposited electrically from an aqueous solution, which deposit is of necessity of a more or less porous nature, it soon tarnishes and assumes a dull bluish white color when exposed to the direct action of the elements. But for a protective coat, say for copper, for which purpose it is used on the tower, it answers very well, as the slight superficial oxidation that takes place protects the metal underneath from further attack, and the neutral color that it assumes harmonizes well with the stone work of the tower.

For interior decorative work which is not exposed to atmospheric changes and can be protected by a coat of lacquer some very beautiful and lasting effects can be produced by its use, as it can be finished with a fine matt or satin finish which is as white as that of silver. This finish may be produced directly in the bath. It is also easily polished.

Aluminum is, no doubt, more difficult to deposit than any other of the common metals. This is because of the high voltage necessary to decompose aqueous aluminum solutions, and its tendency to re-

(*Concluded on page 71*)

Metallography for the Electroplater

Conclusion

By Alex Blazy[1] and J. B. Mohler[2]

Thickness

THE microscopic method is a valuable means for measurement of local thickness. Suppose it is desired to determine the distribution of metal over a plated gear tooth. The gear may be cut and polished through the proper number of steps and examined under the microscope. If such a project is experimental, then it is best to plate heavy and examine under low power since the preparation is greatly simplified for such a case and many of the ordinary tools of the metallographer may be dispensed with. If a heavy deposit cannot be used then it may be necessary to plate a second metal over the original in order to prevent rounding of the deposit and in order to obtain contrast between the two deposited metals.

Figure 8 shows a magnified photograph of bronze gear teeth plated with silver. Examination of the specimen reveals two facts clearly. First: the silver is well distributed over the complicated shape. This distribution was obtained because the teeth were small and the throwing power of the silver bath is high. If the teeth had been large or closer together then this good distribution would not have been obtained. Second: dark lines at several points along the teeth reveal lack of bond, indicating that the preparation of the piece prior to plating was not proper to obtain adhesion.

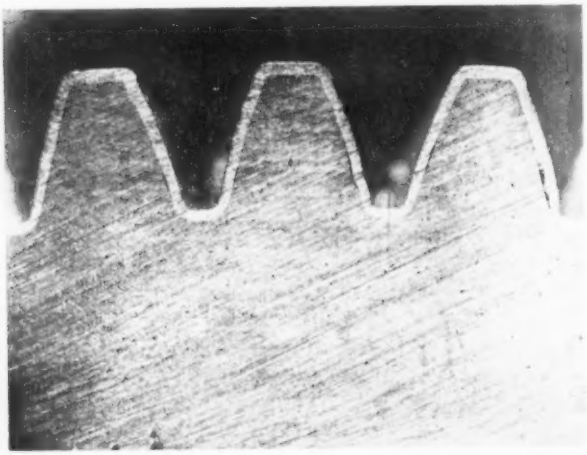


Figure 8. Rough polished specimen of silver plated bronze gear teeth.

Such facts are readily deduced through polishing and examination under low power.

Basis Metal

The condition of the basis metal is often a source of trouble in a plating process. The same metallographic technique that is applied to the deposit may be applied to the basis metal as the surface may be closely examined for films, dirt and imperfections and often troublesome surface material can be discovered and

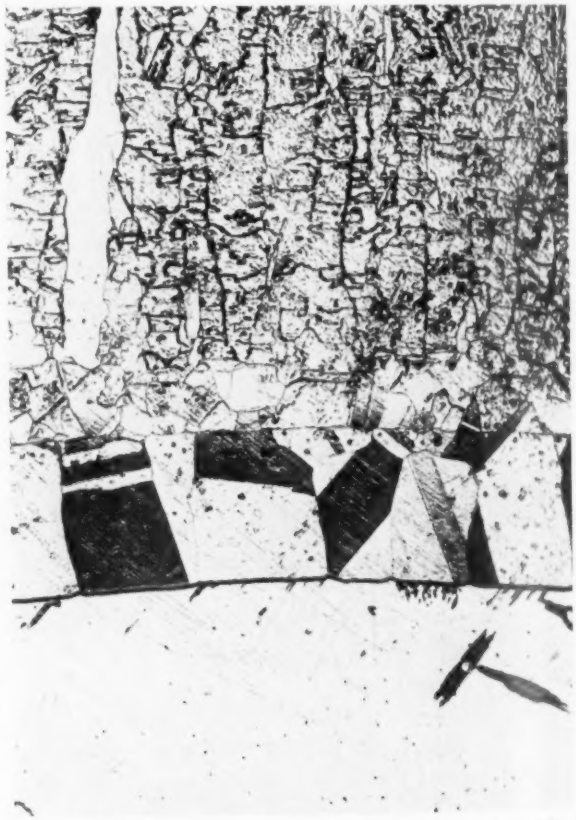


Figure 9. Diffusion alloy formed between brass and electroplated overlay of copper, 50x, as taken by E. O. Kirkendall in the Trans. Am. Inst. Mining Met. Engrs., Inst. Metals Div., Tech. Pub. 1431 (1942).

identified. For example, small particles of rubber may be left on the piece due to work with a rubber wheel

to remove burrs. If these particles of rubber are exposed to a degreaser solvent they may soften and adhere to the work so well that they cannot be removed by the subsequent cleaning steps. If this material is identified under the microscope it may be removed by wiping or it may not cause trouble if the degreasing step is eliminated. A polished section of the basis metal may be examined for cracks and inclusions.

Diffusion

If more than one metal is deposited or if a metal is deposited that will alloy with the basis metal then diffusion of one metal into the other may take place. This diffusion may occur with time and if metal compounds are formed as a result, a brittle layer may be

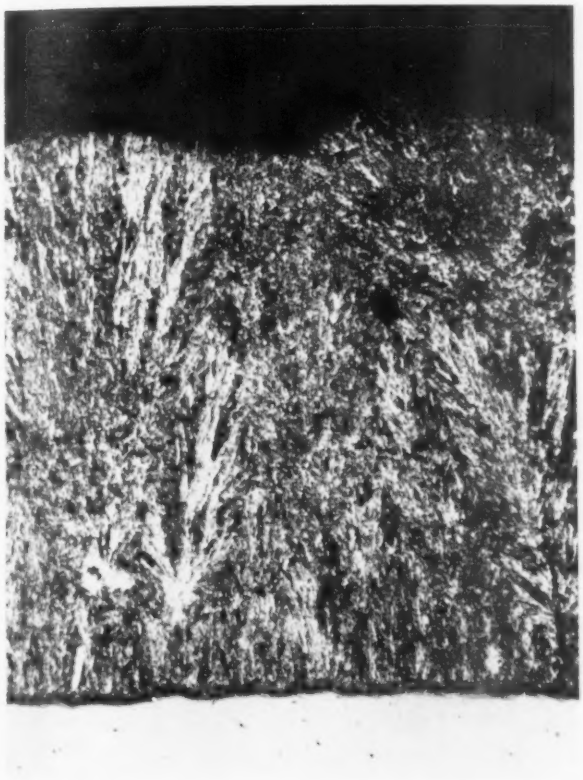


Figure 10. Normal structure for a deposit from a silver cyanide bath. 100x.

formed at the bond line that will limit the application of a product. If the parts are to be heated, as in an engineering application, then this diffusion and bond compound formation may take place in a few hours. These troublesome brittle compounds can often be observed and identified under the microscope.

In some applications diffusion alloys are purposely formed and the rate and extent of formation can be determined by microscopic examination (Figure 9).

Bond

Poor adhesion may be determined under the microscope as a dark line showing separation of the two layers. However, if there is lack of bond it can be readily determined by some other destructive method.

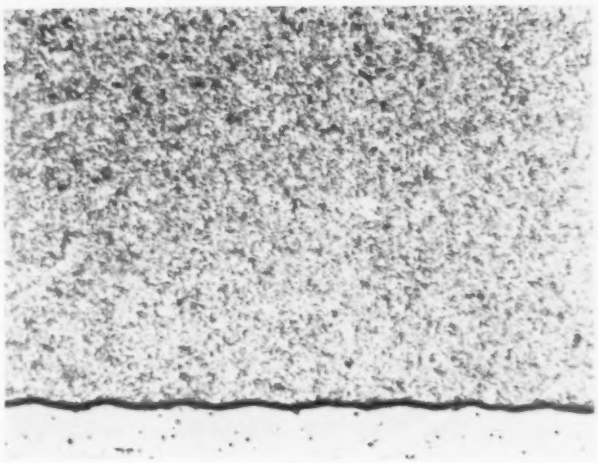


Figure 11. Structure for a bright deposit from a silver cyanide bath.

Structure

Specimens may be examined for structure to indicate uniformity of the effect of an addition agent and to show the effects of annealing. An addition agent will produce a fine uniform structure and annealing will reveal recrystallization; it will also be found that the crystal size after annealing is greatly dependent on the crystal size prior to annealing.

Electroplated Alloys

In the field of alloy deposition the metallographic method may be used to reveal the type of alloy obtained. Whether it be solid solution or a two phase alloy, the phases may often be identified; also the structure may be examined to reveal bonding of the deposit and to reveal homogeniety. By study of the structure and study of the metallurgy of similar thermally prepared alloys much may be predicted of the probable behavior of electrodeposited alloys.

Structure

A polished and etched specimen may be examined for structure. From a given bath a typical structure is usually obtained and often it tells little about the deposit, however, the structure may occasionally change due to impurities in the bath or improper bath limits. These abnormal structures can only be recognized through a knowledge of the appearance of normal structures.

Figure 10 shows a normal structure for a silver bath. The photomicrograph reveals the crystalline character of the plate and the direction in which the crystals grow. In this picture a large pore is revealed that may be associated with the structure.

Figure 11 shows the structure of a silver deposit from a bath in which an addition agent was used; here the crystal structure is very fine and the crystal growth was not as directional as in Figure 10. It is not necessary to examine the structure to know that the plate is finely crystalline for this structure occurs when the

Metal	*Reagent*	*Composition*	*Remarks*	*Use*
1. Aluminum and its alloys	Hydrofluoric acid	HF 0.5 ml. H_2O 99.5 ml.	15 seconds swab	general, microscopic
	Sodium hydroxide	NaOH 10 g. H_2O 90 ml.	5 seconds immersion at 70° C.	microscopic, macroscopic
	Vilella's etch	HF 2 parts HNO_3 1 part Glycerol 3 parts		general
2. Cadmium	Ferric chloride	$FeCl_3$ 10 g. Ethanol 90 g.	5 to 30 seconds immersion	general
3. Copper and its alloys	Ammonium hydroxide Hydrogen peroxide	NH_4OH 5 parts H_2O 5 parts H_2O_2 25 parts	5 seconds or more, swab or immersion	general
	Ammonium persulfate	$(NH_4)_2S_2O_8$ 10 g. H_2O 90 ml.	10 seconds or more immersion	For copper, brass, nickel-silver, aluminum-bronze deep etch
	Nitric acid	HNO_3 with water or alcohol	swab or immersion	
4. Gold	Potassium cyanide	KCN (10% vol.) 1 part	use fresh 1½ to 3 minutes	gold, nearly all gold alloys
	Ammonium persulfate	$(NH_4)_2S_2O_8$ (10% vol.) 1 part		
	Iodine	50% solution of U. S. P. tincture of Iodine in aqueous KI solution	film formed can be removed with KCN solution	gold alloys
5. Iron and steel	Nital	HNO_3 5 ml. Ethyl alchohol 95 ml.	5 seconds to 5 minutes immersion	microscopic, macroscopic
	Picral	Picric acid 4 g. Ethyl alcohol 95 ml.	5 seconds to 5 minutes immersion	microscopic, grain size and structure
	Aqua-Regia	HCl 50 ml. HNO_3 100 ml.	5 seconds or more, swab or immersion	stainless steels
6. Lead and its alloys	Mixed acids	Acetic 1 part HNO_3 1 part Glycerol 4 parts	use fresh	general, microscopic
	Acetic acid Hydrogen peroxide	Acetic 3 parts H_2O_2 (9%) 1 part	10 to 30 minutes	macroscopic, for removing metal
	Nitric acid	50% by volume	use boiling	for removing metal
7. Nickel and its alloys	Flat solution	HNO_3 50 ml. Acetic acid 50 ml.	use fresh 5 to 10 second immersion	nickel nickel-copper
	Nitric Hydrofluoric	HNO_3 20 ml. HF (48%) 15 drops	use warm 15 to 45 seconds immersion	general
8. Silver	Ammonium hydroxide Hydrogen peroxide	NH_4OH (50%) 5 parts H_2O_2 (30%) 1 part	immersion	microscopic, macroscopic
	Dichromate etch	$K_2Cr_2O_7$ sat'd 100 ml. NaCl 2 ml. Na_2SO_4 10 ml.	10% solution with water; use hot	general
9. Zinc and its alloys	Palmerton reagent	CrO_3 200 g. Na_2SO_4 15 g. H_2O 1000 ml.	immersion, rinse with CrO_3 200 g. H_2O 1000 ml.	general

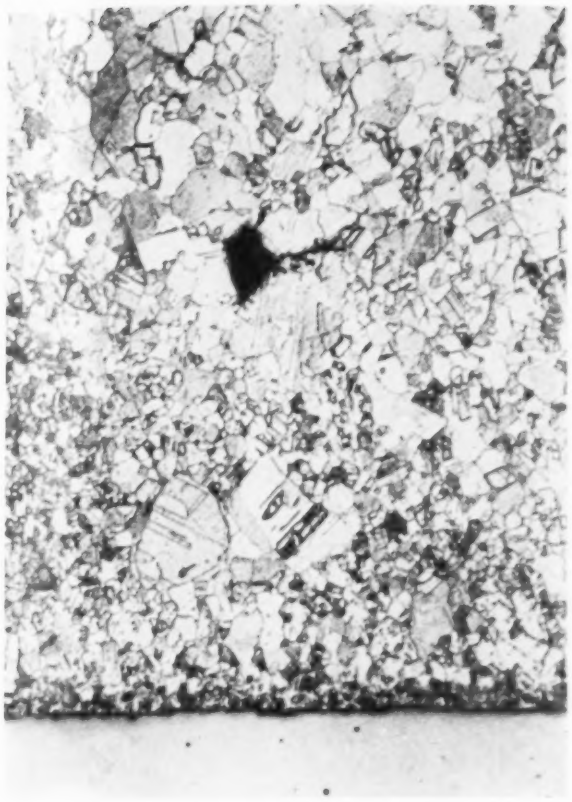


Figure 12. Structure of an annealed silver deposit.

deposit is bright, however examination reveals that the fine structure is notably free of pores.

Figure 12 shows the structure of an annealed silver deposit. In this case recrystallization has taken place and the structure appears similar to what would be obtained for cast silver. A large hole appears in the deposit but the possible cause cannot be as readily guessed from the recrystallized structure.

If a deposit is available it is possible to guess something of its history by examination of structure. Coarsely crystalline deposits are usually obtained from acid baths. Finely crystalline deposits are usually obtained from alkaline baths and very finely crystalline deposits are obtained by the use of addition agents. Recrystallized deposits indicate annealing and if the crystals are large the deposit was either coarsely crystalline before annealing or it was annealed at a high temperature.

If the deposit is coarsely crystalline it is sometimes porous and the nature of the pore formation can sometimes be determined from the manner in which the deposit grows as revealed by the structure.

Etching Reagents

On the opposite page is a list of etching reagents for common metals and alloys which are in general use.

ALUMINUM ELECTROPLATING

(Concluded from page 67)

dissolve after being deposited. The thermal data required to calculate the potential difference or electromotive force necessary to decompose the different aqueous solutions of aluminum were not in Mr. Darling's possession, but, reasoning by analogy, it must be several volts in each case, and as water requires only a minimum electromotive force of 1.5 volts to decompose it, at first glance it would seem that a compound which requires over 2 volts for its decomposition in aqueous solution would involve the decomposition of the water, and therefore would be impossible. But in reality this is not so, as may be seen in the case of caustic soda, which requires over 2 volts. Yet sodium may be obtained by its electrolysis if mercury be present to absorb it and protect it from the water.

The fact is that when two substances are present requiring different E. M. F. to decompose them, if the E. M. F. is high enough to decompose the higher compound, the current is divided between them in some ratio decomposing them both, and Mr. Darling found that by using a solution of aluminum that had but a slight dissolving effect on aluminum, with a density of current of 8 amperes to the square foot, with sufficiently high voltage (6½ to 7), aluminum could be deposited on the cathode at the rate of one gram per hour per square foot, in a reguline state, and with higher currents it could be deposited much quicker, but was in a pulverulent state, which did not adhere.

INDUSTRIAL NICKEL PLATING

(Concluded from page 59)

can work of this nature be obtained for my plating plant? The possibilities lie on every side—machine shops, bus companies, mines, chemical manufacturing plants, marine engineering works, airplane factories, oil refineries, paper mills, printing plants, textile mills; in general, any user of machinery or equipment which is subject to wear or corrosion, any plant manufacturing parts which might be mismachined. As in many businesses, it is necessary for someone to go out into the shops, plants and factories and actually dig out the work. The purchasing agent or design engineer is often a useful person to interview, as no part can be salvaged or repaired unless it originally cost more than the cost of a salvaging operation.

There are several methods for calculating the cost of heavy nickel plating. In one the definite labor charge involved in the job itself is added to an amount based on the total number of ampere-hours required for the plating. In another system the total direct labor charge is multiplied by 2½, to which is added the cost of the deposited nickel.

References

1. Roehl, *Metal Finishing*, 39, 182 (1941).
2. Pinner and Kinneman, *Monthly Rev.*, A. E. S. 32, 227 (1945).
3. Helbig, *Proceedings*, A. E. S., 69 (1941).
4. Liscomb, *Metal Industry* (N. Y.) 31, 235 (1933).
5. Weisberg, *Metal Industry* (N. Y.) 35, 451 (1937).
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5. Weisberg. *Metal Industry* (N. Y.) **35**, 451 (1937).
6. Mattacotti. *Monthly Rev.*, A. E. S. **25**, 513 (1938).

Rectifiers for Electroplating—Part III

By Louis W. Reinken, *Chief Engineer, W. Green Electric Company, Inc., New York City*

Parallel and Series Connections—Theory

IT is now pretty well known that one of the unique features of rectifier power supplies is that two or more rectifier units may be connected in parallel to obtain greater current capacity, or, alternatively, connected in series to obtain higher voltage. The basic theory of such parallel and series connections is quite simple, but occasionally there are misunderstandings about what can and cannot be done with such circuits.

A fairly accurate analogy to rectifier connections is the parallel or series connection of batteries. For instance, an automobile storage battery is usually made up of three cells connected in series (Fig. 16). Each cell has a potential of approximately 2 volts, so the total voltage of the three cells is 6 volts. Similarly, three 6 volt rectifier units in series, would have a maximum potential of 18 volts.

Note that in series connections, the positive terminal of one battery cell (or rectifier) is connected to the negative terminal of the next, and so on, leaving two terminals free—the negative terminal on one end of the line and the positive terminal on the other end. The voltage between these two free terminals is equal to the sum of the voltages of the individual links in the chain.

In the sketch we have shown the chain as made up of links of equal voltage, i. e., three 2 volt cells in the battery and three 6 volt units in the rectifier group, but they do not have to be all alike. For instance, 18 volts could be obtained by connecting a 6 volt unit in series with a 12 volt unit.

What is more important, from a practical standpoint, is that the current capacity (ampere rating) should be the same for all the units connected in a series group. It is obvious that the current which flows through the plating tank must flow also through each of the rectifier units in turn and therefore the maximum current which may be safely drawn is determined by the safe current rating of the lowest capacity rectifier unit.

In an emergency, to obtain 12 volts, a 6 volt 500 ampere unit might be connected in series with a 6 volt 2000 ampere unit but the maximum safe current rating of this 12 volt combination would be only 500 amperes—the same as that of the smaller unit. This is just another example of the theory of "the weakest link in the chain." Incidentally, this explains also why, if a large number of rectifier units are required, and maximum flexibility is needed, it is desirable to standardize on a single voltage and current rating if possible.

Parallel Connections

When similar rectifier units are connected in parallel (Fig. 17), the maximum voltage obtainable is not increased but the maximum ampere rating is increased.

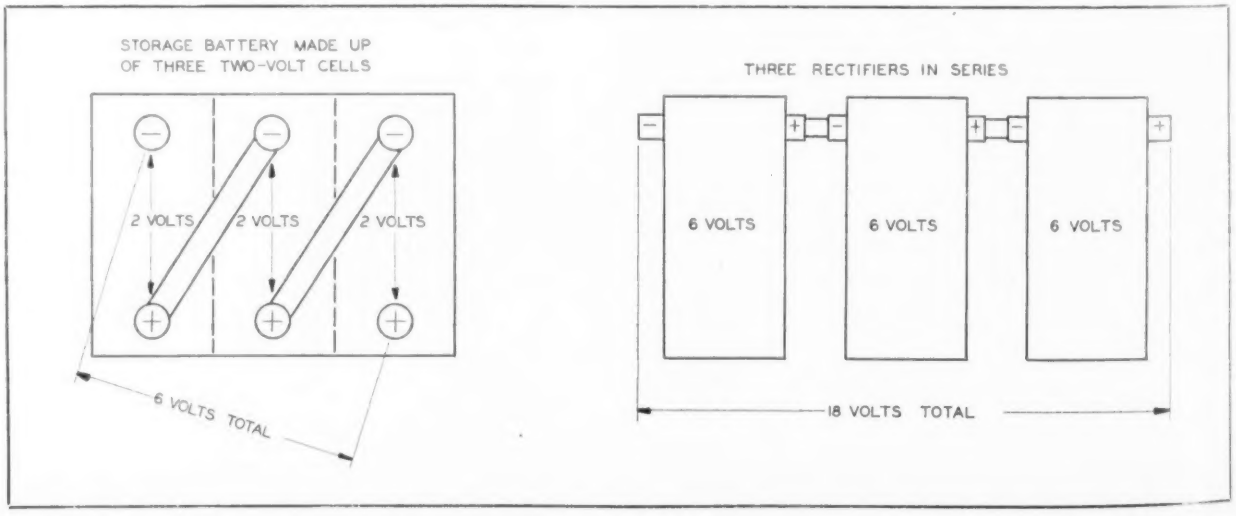
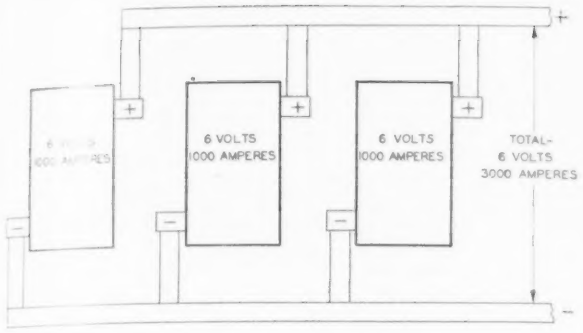
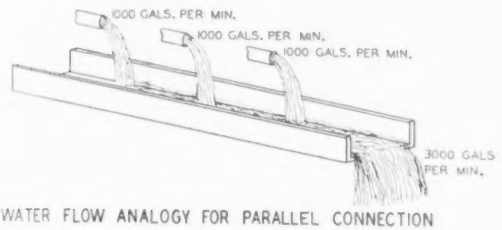


Figure 16. Series Connections.



THREE RECTIFIER UNITS IN PARALLEL



WATER FLOW ANALOGY FOR PARALLEL CONNECTION

Figure 17. Parallel Connection.

This is a bit more difficult to visualize mentally, but the water flow analogy shown in the same figure may help. The idea is that if each of the three pipes is contributing 1000 gallons per minute the total current flow in the common pipe is 3000 gallons per minute. Similarly, three 6 volt 1000 ampere rectifier units in parallel have a total maximum rating of 6 volts 3000 amperes, since each contributes a maximum of 1000 amperes to the tank.

The water flow analogy applies also if the rectifier units are of different current ratings. For instance, one of the units in Fig. 17 might have a rating of only 500 amperes and the other two 1000 amperes each, in which case the combined current rating would be 500+1000+1000=2500 amperes. Rule: the maximum safe current capacity of a group of parallel-connected rectifier units is equal to the sum of the safe current ratings of the individual units in the group.

As Fig. 17 shows, in parallel connections all the positive terminals connect to a common positive busbar and all the negative terminals to a common negative bar. There are no terminals "left over" as in the case of the series connection. It is obvious from the sketch that the voltage across the positive and negative terminals of any individual rectifier unit must be identical with the voltage across any other pair of terminals and, excepting for busbar drop, will be identical also with the voltage across the tank.

Variable Voltages

This brings us to something which can be very puzzling, but which can be explained only in terms of electrical circuit theory. (A hydraulic analogy could be drawn, but this would be just as difficult to understand as the electrical theory.) The question is sometimes asked, "What would happen if one of the three rectifiers (as shown in Fig. 17) were set for 5 volts, and the other two set for 6 volts?"

Actually, as we have just shown, it is not possible to adjust the rectifiers to different voltages if by "voltages" we mean the potentials measured across the output terminals of the individual rectifiers. Since these terminals are all firmly connected together by common busbar, the voltages across the several pairs must be identical. This seems to complicate the puzzle, since it appears obvious that changing the voltage controls on one of the units should change the voltage across its output terminals.

The key to understanding what happens is that a rectifier, like any other electrical device, has *its own internal resistance*, entirely independent of any external resistances which may exist in the circuit to which the rectifier is connected. External resistances include the very low resistance of the copper busbar, the resistance of the plating tank anodes, solution, work, etc., also the resistance of the tank rheostat, if used.

That this resistance is real and acts like any other resistance can be seen by observing what happens on the voltmeter scale of a single rectifier unit when the amount of work in the tank is increased. Assume that with no work in the tank (zero amperes), the voltmeter indicates 8 volts across the output terminals. With one rack of work in the tank, let us assume that the voltage drops from 8 to 7.5 volts, with two racks to 7 volts, and with four racks to slightly above 6 volts.

The decrease in terminal voltage of nearly 2 volts is due to the voltage drop within the rectifier across the *internal* resistance of the rectifier plates, and to a smaller extent, across the internal resistance of the transformer windings. (Strictly speaking, the internal

Figure 18-A. All units identically adjusted.

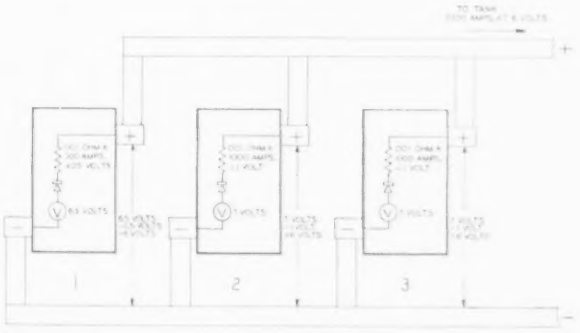


Figure 18-B. Units not identically adjusted. No. 1 set to lower voltage.

resistance of a rectifier unit does not follow exactly the same law as a pure resistance of a tank rheostat, but this is near enough to explain the problem at hand.)

In Fig. 18, this total internal resistance of rectifier and transformer is represented by IR.

There is one other characteristic of rectifiers which is important for parallel connections and, in fact, which makes operation of units in parallel a practical proposition; a rectifier will not permit current to flow the wrong way through the rectifier itself. To be absolutely accurate, we should modify this statement by saying that at the most, a rectifier will permit only a small backleak of reverse current to flow. (In selenium and copper oxide rectifiers, this backleak current is negligible.)

This "valve" characteristic is represented in Fig. 18 by the arrowhead indicating which way the current can flow readily. To complete Fig. 18, we represent the internal voltage of a rectifier unit by a circle marked "V" and this is the voltage which is actually changed when we change the voltage control settings.

Now we are ready to deal with the puzzle of what happens if all of the rectifier units are not set to the same voltage. It must be understood that when the voltage control of one of the rectifier units is adjusted, it is the internal voltage "V" which is directly changed. What happens across the output terminals depends also upon the internal voltages of the other two rectifiers and the current drawn by the tank.

In "A" of Fig. 18 is shown an ideal condition where all three rectifiers are set at the same internal voltage and "B" shows what happens when the controls of one of the three units are adjusted "downward" to reduce its internal voltage.

In "A" we have assumed: (1) that the internal resistance is .001 ohm in each rectifier; (2) that the controls have been adjusted so that the voltage across the tank is 6 volts and (3) that the amount of work in the tank is such that 3000 amperes is drawn. If each rectifier unit contributes 1000 amperes to the total, then the internal voltage drop in each rectifier will be 1000 x .001 or 1 volt. Therefore, the internal voltage will be equal to the 6 volts across the output terminals plus the 1 volt internal drop, making a total of 7 volts. This 7 volt figure is not an imaginary voltage. That it actually exists could be shown by disconnecting the rectifier from the common busbars and the tank. Without touching its voltage controls, the voltage across the output terminals would then be 7 volts, the same as the internal voltage we computed. With no current flow there would be no voltage drop in the internal resistance.

In "B" of Fig. 18, we have changed the controls on the first rectifier unit so that its internal voltage has been reduced to 6.5 volts. Assume that the tank conditions are such that the tank voltage measures 6 volts (This is not the same as the tank condition in "A", incidentally. The tank resistance was deliberately changed to simplify the arithmetic.) Under these conditions, a current of 500 amperes through the .001 ohm internal resistance of Unit No. 1 will cause a drop of 0.5 volt, i. e., there will be 6 volts across the terminals; and in Units Nos. 2 and 3, a current of 1000 amperes each will provide a 1 volt drop from the internal voltage of 7 volts, so that across these output terminals the voltage will also be 6 volts.

What happens is this: when the controls on any one unit are adjusted, the current contributed by each rectifier unit to the tank automatically changes so that in each rectifier the internal voltage minus the internal drop is equal to the tank voltage. Furthermore, adjusting the controls "downward" (in a direction to reduce the internal voltage) will reduce the amperes delivered by that rectifier and to a slight extent the current delivered by the other units will increase to take up the slack. Also, the voltage across the plating tank will decrease slightly.

It is possible to reduce the internal voltage of one of the units to the point where it is exactly equal to the tank voltage, i. e., the terminal voltage of the other units. This means simply that this rectifier unit delivers no current to the tank and its ammeter drops to zero.

If the internal voltage is reduced still further, it would be logical to expect current to flow through the rectifier in the reverse direction—that is, for the ammeter to indicate a negative current flow. (This would actually happen with any kind of power supply other than a rectifier.) This is where the "valve action" referred to previously comes into play. The rectifier prevents reverse current from flowing and the ammeter remains at zero—or at most, indicates a very slight, almost imperceptible reverse current flow.

This valve action, which blocks reverse current flow, makes it possible, in a group of parallel-connected rectifiers, to leave one or more rectifier units shut down completely (internal voltage zero) when supplying a light load from the remaining units. Theoretically, it may be preferable to divide the load between all the rectifier units, since in the region of fifty percent of the maximum current rating, most rectifiers reach their maximum efficiency, and therefore, the total AC power consumption would be slightly less than when operating only a few of the units near their maximum rated capacity.

Summary—Parallel Operation

From the foregoing analysis, we can make several specific statements about parallel-connected rectifier groups:

1. The *internal* voltages and *internal* resistances of the individual rectifier units determine how the total current load will be divided between the rectifiers.

2. The current contributed by only one rectifier may be increased by increasing its internal voltage, and decreased by decreasing its internal voltage. The internal voltage may be changed by adjusting the voltage controls, if the rectifier is equipped with controls.

3. Under no circumstances is there any possibility of large reverse current flowing through a parallel-connected rectifier. The rectifier current will be zero

(*Concluded on page* 77)

This Is Washington

By George W. Grupp, *Metal Finishing's Washington Editor*

Labor Relations Courts Wanted

The American public has become impatient after much suffering from strikes during the past two years because of the inadequacy of existing labor laws and because of the unsatisfactory results of the present machinery of boards, commissions and bureaus in settling disputes between management and labor. These disputes have become intolerable for they threaten national paralysis every few months.

To correct the faults of existing labor laws and certain abuses, Congress is considering amendments to some labor statutes. And to protect workers against unfair employers and power greedy labor unions and to improve the conciliation and mediation machinery, and to properly enforce existing labor laws and the proposed labor legislation, Senator Homer Ferguson of Michigan and Senator H. Alexander Smith of New Jersey introduced S. 937 which provides for the establishment of eleven United States District Labor Relations Courts—one in each of the ten judicial circuits of the United States, and one in the District of Columbia.

In presenting this measure to Congress, Senator Ferguson among other things said: "Labor-industrial disputes should come within the jurisdiction of a court established to handle them. The machinery to provide the legal discipline of a civilized society must be designed as nearly as humanly possible to carry out two basic principles: first, that we are a government of law and not of men; and second, that there must be equal justice under the law."

Of course the sponsors of this proposed legislation are aware of the difficulty of establishing labor relations courts for it is an experiment. These courts will not have the power to compel collective bargaining contracts. Instead they will be limited to interpret and enforce collective-bargain agreements, and to interpret labor laws where ordinary mediation efforts have failed in disputes affecting interstate commerce.

In such cases these labor courts will be able to enforce settlements by fines, injunctions, judgments, orders and other measures against either union leaders or employers. And they will have authority to over-rule the decisions of the National Labor Relations Board when they see fit to do so.

Each labor relations court will be presided over by three judges. Two must be attorneys-at-law; and one shall not be an attorney-at-law.

In order to facilitate speedy settlements of labor-management disputes one of the judges may conduct pre-trial conferences (1) to define and simplify the issues in the disputes, (2) to obtain admissions of facts and necessary documents, and (3) to avoid, if possible, formal labor relations court procedure by making adjustments, compromises or settlements.

Obviously these labor relations courts will relieve the already over-burdened ordinary courts of law. They will expedite the settlement of labor-management disputes. They may reduce the number of strikes. And they will give all parties concerned the benefit and considered judgment of jurists with a special knowledge of labor laws and labor relations and with no political axes to grind.

Naturally this labor relations court measure will be fought by both labor and management because it is a form of compulsory arbitration, because it might encourage labor litigation, and because it will expand Government regulation and control of private enterprise.

The Proposed Labor-Management Relations Act

Congress expects to pass the omnibus labor bill, H.R. 3020, which will be known as the "Labor-Management Relations Act." The Senate, some believe, will soften some of the tough provisions of the bill as will be passed by the House. And should the President veto this severe labor measure, then Congress may pass it over the Executive veto.

Of course Representative Fred A. Hartley, Jr. of New Jersey, Chairman of the House Labor Committee, who sponsored this measure is aware that a "deliberate wave of strikes" might follow the passage of this bill. He feels that the country cannot further delay a showdown. And he is of the opinion that if union leaders overstep their prerogatives public sentiment will turn against them.

In a statement issued by the American Federation of Labor on H.R. 3020 one finds this observation: "Chairman Fred A. Hartley, of the House Committee on Education and labor, in publishing the contents of the bill on April 10, said that the bill was "our

response to the mandate that the people of the people of the United States gave us last November." We will not venture a guess as to what group of people Congressman Hartley refers as "the people of the people." We are sure, however, that he "is misreading and misstating the people's vote of last November. The November vote was a protest against a far-reaching Government bureaucracy and excessive Federal controls extended into peacetime. Then, as now, the people were fed up with governmental intervention into their private decisions and Government control of their private activities and transactions. It was a clear and ringing mandate against the very kind of legislative enactment Mr. Hartley has prepared for the consideration of Congress."

Those who look upon this measure with disfavor, as it now reads, give many reasons for their opposition. They say that they are opposed to the proposed labor-management relations act (1) because it is "hypocritical in the extreme"; (2) because it is a "most vicious, restrictive, and destructive anti-labor bill"; (3) because it will "take us back to the Dark Ages with respect to labor-management relations"; (4) because it does not provide an equitable settlement of labor-management disputes; (5) because it authorizes the Government to intervene in the process of collective bargaining; (6) because it provides a detailed regulation on the steps in the collective-bargaining process; (7) because strike and lock-out notices must be sent to the Administrator of the Act; (8) because the measure limits the collective bargaining procedure to stated items; (9) because they fear supervisors may be excluded from collective bargaining; (10) because it may be difficult to get employers to agree to minimum requirements of manning, safety and health; (11) because it "gives each member of a labor organization the right to be free from unreasonable or discriminatory financial demands of labor organizations"; (12) because it eases the present NLRA requirements; (13) because it outlaws the check-off of dues; (14) because it outlaws employer contributions to benefit, health and welfare funds; (15) because it makes it unlawful "to compel anyone to become or remain a member of a labor organization"; (16) because it prohibits unions from maintaining compulsory insurance and benefit plans; (17) because it drastically modifies the present procedure on the certification of representatives; (18) because it forbids the NLRB from ordering the reinstatement of any individual as an employee "unless the weight of the evidence shows that such individual was not suspended or discharged for cause"; (19) because it takes from the states, and places under Federal jurisdiction, certain labor regulatory controls; (20) because it makes picketing subject to Federal control; (21) because it weakens the Norris-LaGuardia act; (22) because it prohibits a "national union from paying strike benefits in any strike"; and (23) because "when a union engages in an unfair labor practice, it promptly loses the right of its very existence."

Those in favor of the measure are not in agreement with those objections. Take Representative Leo E. Allen of Illinois, for example. In addressing Congress on H.R. 3020 he said: "This bill does not seek to curb any of the legitimate rights and privileges of labor or labor unions. Its sole purpose is to eliminate the injustices arising out of conflicting provisions in the two basic Federal statutes regulating labor relations,—the Wagner Act and the Norris-LaGuardia Act."

And then without trying to fix the responsibility of the present unsatisfactory labor laws in defining the responsibilities and rights of both labor and management he pointed out why we have not a basic law insuring industrial peace by saying: "Neither Congress nor the Executive has the power to regulate labor relations. Such power is not specifically granted by our Constitution, and therefore it remains within the jurisdiction of the individual states. Consequently, in order to regulate labor relations, Congress has used its powers to regulate interstate commerce, and its powers to define and control the jurisdiction of the courts. The Wagner Act and the Railway Labor Act, for example, are both based on the authority of Congress to regulate interstate commerce; and the Norris-LaGuardia Act is the result of the power of Congress to define the "jurisdiction and procedure of the courts. As a result of this limitation on the powers of Congress, and the necessity of using other powers by the Constitution, national labor policy has been expressed indirectly and in a somewhat fragmentary manner."

In presenting H.R. 3020 to Congress, Representative Fred A. Hartley said that (1) it outlaws the closed shop; (2) it outlaws monopolistic industry-wide bargaining; (3) it exempts, but does not bar, supervisors from compulsory features of the National Labor Relations Act; (4) it imposes on both labor and management the duty of bargaining; (5) it requires a secret ballot by employees on bargaining arrangements; (6) it eliminates the National Labor Relations Board and sets up a new board with different functions; (7) it protects labor unions which are not affiliated with some national organization; (8) it outlaws picketing when employers are not involved in the disputes; (9) it provides the right to sue for damages and injuries suffered from unlawful concerted activities; (10) it outlaws mass picketing designed to prevent persons from entering or leaving a place of business; (11) it gives both labor unions and employers the right to sue for a violation of a contract; (12) it outlaws sympathy strikes, jurisdictional strikes, illegal boycotts, collusive strikes, sit-down strikes, featherbedding, and other concerted interferences on an employers' premises; and (13) it aims "to stop Mr. J. C. Petrillo from keeping American school children from going on the air."

In reply to those who claim the bill will oppress workingmen, Representative Hartley said that his bill guarantees to the workingman: "First, the right to join with fellow workers to select a collective-bargaining agent of their own choosing. Second, it gives him the right to get a job without joining a union. Third, the right to vote by secret ballot in a fair and free election on whether his employer and a union can make him join the union to keep his job. Fourth, the right to require the union that is his bargaining agent

to represent him without discriminating against him in any way or for any reason, even if he is not a member of the union. Fifth, the right with his fellow employees to make demands of their own and to bargain about them through the leaders of their own local union without dictation by national and international officers and representatives, and without regard to the demands of other employees upon other employers."

"Sixth, the right to keep on working and getting his pay without sympathy strikes, jurisdictional disputes, illegal boycotts, and other disputes that do not involve him, and his union or his employer. Seventh, the right to know what he is striking about before he is called out on strike, and to vote by secret ballot in a free and fair election on whether to strike or not after he has been told what his employer has offered him. Eighth, the right to express his opinion concerning union politics, union officers and candidates for union office, and to make and file charges against his employer, the union, or the union officers without suffering any penalty or discrimination. Ninth, the right to vote by secret ballot without fear in free and fair elections on any matter of union policy—how much dues he shall pay, what assessments the union can make him pay, what the union can spend the money for. Tenth, the right to vote by secret ballot in free and fair elections for his own choice of union officers.

"Eleventh, the right to know how much money his union has, how much it pays its officers, and how much of the union's money the officers use for their own expenses. Twelfth, the right to refuse to pay the union for any kind of insurance that he does not want. Thirteenth, the right to receive his pay in his pay envelope, without the employer and the union spending it for him, checking it off for union dues or for other purposes. Fourteenth, the right to stay a member of a union, without being suspended or expelled, except for, first, not paying dues; second, disclosing confidential information of the union; third, violating the union contract; fourth, being a Communist or fellow traveller; fifth, being convicted of a felony; sixth, engaging in disreputable conduct that reflects on the union.

"Fifteenth, the right to be free of threats to his family for doing things in connection with union matters that an employer or a union does not like. Sixteenth, the right to settle his own grievances with his employer. Seventeenth, the right without fear of reprisal to support any candidate for public office that he chooses and to decide for himself whether or not his money will be spent for political purposes. Eighteenth, the right to go to and from his work without being threatened or molested. Nineteenth, the right of a union free of Communist domination and control, and one that is devoted to honest trade unionism and not class warfare and turmoil. Twentieth, the right to strike for any legitimate object that he has had under our laws since labor has had the right to strike. And finally, the right to have a fair hearing before an impartial board, without cost to himself, whenever he believes that any employer or any union is depriving him of these rights."

Thorium-Coated Anodes

In a report on "Special Materials for Radio Valves," (PB-27712; price, photostatic copy, $2.00), it is claimed that thorium-coated anodes increased the efficiency of German radio tubes by helping to produce and maintain high vacuums. The report describes the German methods of applying thorium, zirconium, and aluminum alloy plating on electrodes and other radio parts. It states that thorium coatings are particularly suitable for anodes made of iron, nickel, molybdenum, and carbon. To coat electrodes, the Telefunken Wireless Telegraphy Company used a cataphoretic process —electrodeposition from a paste or solution containing thorium in a colloidal state. In addition to powdered thorium, the paste included pure methanol, acetic acid, aluminum nitrate, and nitric acid. The nitric acid was used to prevent the formation of dimethylamine and trimethylamine which coagulates thorium paste. A special iron plated on both sides with aluminum alloy, the reports says, proved superior to carbonized nickel for radio tube anodes at temperatures below 900 degrees centigrade. The aluminum alloy plating of the anodes was about 10 to 15 microns thick.

Equity Discarded in Capital Gains Tax

Recently the United States Supreme Court ruled that when one sells property subject to a mortgage, the taxable capital gain shall be based on the entire property rather than on the "equity" in the property.

RECTIFIERS FOR ELECTROPLATING

(*Concluded from page 74*)

if the internal voltage is low or if the rectifier is shut down.

4. If the tank current is already divided more or less equally between the rectifier units in a parallel group and it is desired to increase or decrease the tank voltage, then *all* the voltage controls if there are individual controls on each unit, should be changed upward or downward by an *equal* amount, in order to maintain the equal division of current between the rectifiers. Naturally, the total current, and the individual currents, will increase if the tank voltage is raised and decreased if the tank voltage is lowered.

There is only one important rule in operating a group of parallel-connected rectifiers, if the rectifiers are equipped with individual controls and ammeters:

5. *The current contributed by any one rectifier is indicated by its own ammeter, and under no circumstances should this current be allowed to exceed the safe current rating of that particular rectifier.*

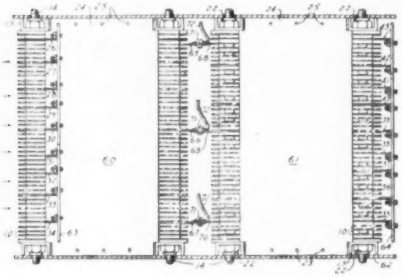
At tank currents less than the total maximum rating of the rectifier group, it is not necessary to divide the total current equally between the rectifier units, although this may be desirable for maximum efficiency. All that matters is that no individual rectifier unit be overloaded beyond its own maximum rating.

Patents

Rectifier Assembly

U. S. Pat. 2,416,152. *Herman J. Braun, assignor to Westinghouse Electric Corp., Feb.* 18, 1947

A three-phase rectifier assembly of the dry plate type comprising a plu-



rality of rectifier plates disposed in two stacks adapted to operate in different ambient temperatures, the plates of each stack being connected in three electrically similar groups adapted to function as arms of a rectifier bridge circuit, means for connecting one end of each group of plates in one of said stacks to a direct-current output lead of one polarity, means for connecting one end of each group of plates in the other of said stacks to a direct-current output lead of opposite polarity, means for connecting the remaining end of each group of plates in one stack to the remaining end of a group of plates in the other stack, and means for connecting said last-mentioned connecting means to three-phase alternating-current input leads.

Abrasive Impregnated Rubber

U. S. Pat. 2,418,250. *Charles E. Drake, assignor to United States Rubber Company, April* 1, 1947

An abrasive article comprising abrasive grains and a bond containing the vulcanization product of a mixture of rubber, sulphur in amount to vulcanize said rubber to hard rubber and copolymer of a major proportion of isobutylene and a minor proportion of a conjugated diolefine selected from the group consisting of butadiene-1,3, isoprene, 2,3-dimethyl butadiene-1,3 and pentadiene-1,3 copolymerizable therewith, the proportions of rubber and the copolymer of isobutylene and conjugated diolefine being within the range 1:5 to 5:1 parts by weight.

pH Measurement Cell

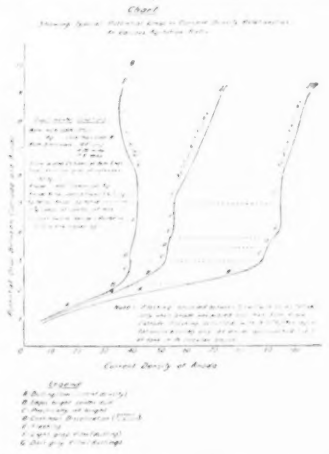
U. S. Pat. 2,416,949. *George A. Perley and James B. Godshalk, assignors to Leeds and Northrup Co., March* 4, 1947

A cell for measuring the pH of a solution containing molecular oxygen and free of molecular hydrogen comprising in contact with the solution a non-porous iridium measuring electrode, uncontaminated by occluded hydrogen, and whose voltage/pH characteristic is consistently reproducible and approximates that of the theoretical oxygen electrode.

Electrolytic Polishing

U. S. Pat. 2,416,294. *Samuel E. Eaton, assignor to Arthur D. Little, Inc., Feb.* 25, 1947

In the anodic polishing of silver, copper, cadmium, alloys consisting of these metals, brass and nickel silver, in cyanide baths, the improvement which comprises employing a substantially constant potential difference between the electrodes which is below the point at which periodic flashing or permanent film formation occurs, and as an aid in establishing and main-



taining the constant potential difference, moving the anode with respect to the electrolyte and solid objects in such a manner that turbulence is avoided and the anode does not approach another solid so closely that flashing is produced, and maintaining these conditions for a period of time to effect the dissolution of superficial protuberances from the surface and to leave the surface polished.

Heat-Treating Electroplated Strip Steel

U. S. Pat. 2,418,087. *John S. Natchman, March* 25, 1947

The method of heat treating material electroplated with a coating of tin for brightening the tin surface which includes the steps of passing the material in a first closed space through the vapor of a hydrocarbon medium of high thermo-conductivity and high thermostability which boils between 97° F. and 300° F. and maintained at a temperature just below the melting point of tin to preheat the coating, then passing the material in a closed space through said hydrocarbon vapor maintained at a temperature above the melting point of tin to melt the coating and then passing the material in a closed space through a bath of said hydrocarbon medium cooled to a liquid state to solidify the coating, all without exposing the material to the atmosphere.

Sizing and Dressing Means

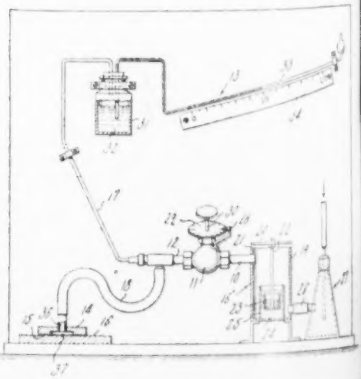
U. S. Pat. 2,415,408. *Jacques Bergier, Alfred Eskenazi and Andre Helbronner, vested in the Alien Property Custodian. Feb.* 11, 1947.

Sizing and dressing means consisting of water 77% as principal solvent, ethanol 9% as an auxiliary solvent, sodium resinate 9% as a sizing and dressing agent, triethanolamine 2% as an emulsifying agent and sodium sulphoricinoleate 2% as a softening agent and mineral oil 1% as a plastifier.

Surface Roughness Measuring Apparatus

U. S. Pat. 2,417,988. *Melvin Mooney, assignor to United States Rubber Company, March* 25, 1947

A rugosimeter comprising a conduit, a contact plate, a continuously adjustable aerodynamic resistance within the



conduit, means for supplying gas at superatmospheric pressure to the inlet of the conduit, the outlet of the conduit being connected to the contact plate adapted to be maintained in con-

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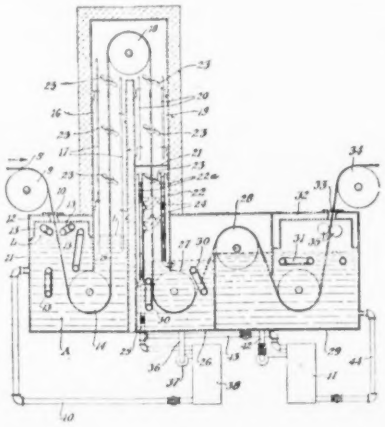
tact with the surface to be tested in such a way that the gas in escaping from the conduit must pass between the smooth surface of said plate and the surface to be tested, means for indicating the relative resistance value of said adjustable aerodynamic resistance, and means for comparing the gas pressure drop across said aerodynamic resistance with the gas pressure drop across the test sample.

Fusion of Tin Plate

U. S. Pat. 2,418,088. *John S. Nachtman, March* 25, 1947

The method of heat treating metal electroplated with tin, which includes heating a hydrocarbon medium selected from a group of petroleum and coal tar fractions which boil below the melting point of tin to vaporize the same and confining said vapor; passing said electroplated metal directly through a portion of said confined

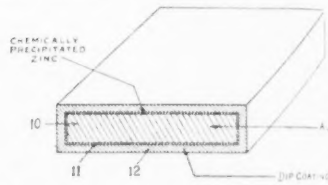


vapor to condense some of said vapor on said electroplated metal and pre-heat the same, then momentarily melting the tin coating in a second portion of said vapor maintained at a temperature above the melting point of tin, then quickly cooling the electroplated metal to below the point of solidification of said tin coating by spraying a portion of the hydrocarbon medium thereon; and then passing said electroplated metal directly through a liquid hydrocarbon maintained at a temperature which will cool the tin coating below its oxidation temperature.

Metallic Coatings for Aluminum

U. S. Pat. 2,418,265. *Joachim Kosopiun, assignor to Sherka Chemical Company, Inc., April* 1, 1947

Process for coating aluminum and aluminum alloys by dipping the same into molten metal, comprising subjecting aluminum or its alloys to a preliminary treatment with a solution of an alkali metal zincate containing

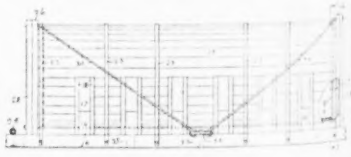


potassium copper cyanide until a chemically precipitated metal deposit in well covering and firmly adhering form is obtained, and dipping the so coated aluminum into a molten bath of a member of the group consisting of zinc, tin, lead and their alloys.

Metal-Lined Wooden Tank

U. S. Pat. 2,417,979. *Roy E. Gilmore, March* 25, 1947

A tank of the class described consisting of a horizontal cylindrical shell of light gage metal, a wooden casing surrounding the cylindrical portion of said shell, cradles disposed along the length of said casing adapted to maintain the lower portion thereof in a semi-cylindrical form, a head disposed



across each end of said casing extending partially into said casing and contacting the end thereof, skids for supporting said shell and heads and truss rods between said heads and intermediate portions of said skids.

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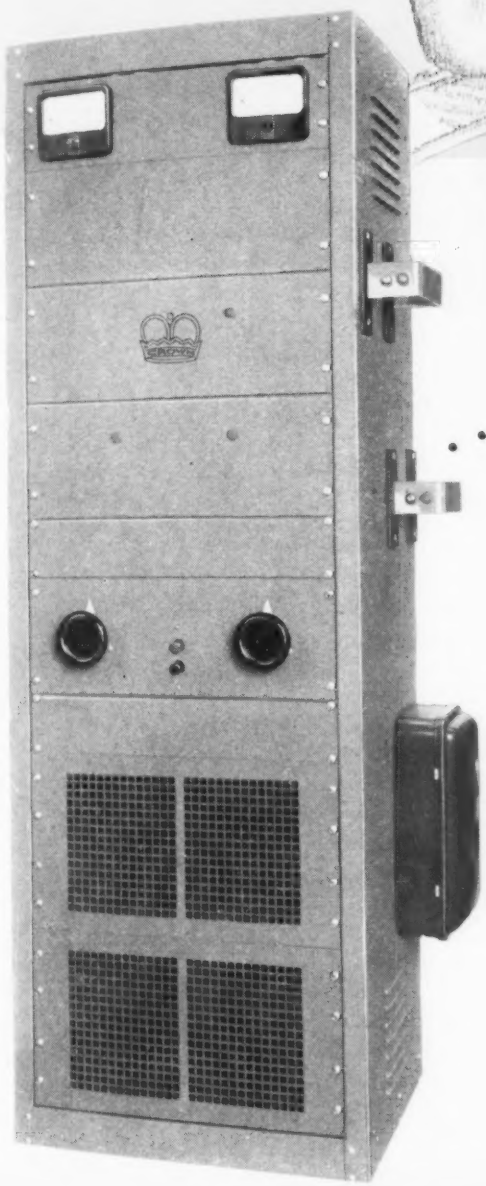

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INDUSTRIAL CHEMICAL & EQUIPMENT CO.
318 Builders Exchange
MINNEAPOLIS 2, MINNESOTA

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating on Solder

Question: We are manufacturing Metal Picture Frames. These frames are of brass soldered together with 60% lead and 40% tin soft solder. Our specific problem is covering the solder in our plating without scratch brushing. We would like to get into mass production.

Our procedure now is:

1. Caustic soda reverse current;
2. Rinse in cold running water;
3. Bright dip in one part nitric, one part water and one part sulphuric;
4. Rinse in cold running water;
5. Rinse in 6 ounces per gallon sodium cyanide;
6. Scratch brush solder around hinges and ornaments;
7. Brass plate;
8. Buff;
9. Gold flash;
10. Dry and lacquer.

As this is a very expensive and slow way of getting production we would appreciate any information you can offer.

A. J. C.

Answer: To plate 60-40 solder is a difficult matter under any conditions; however, the following suggestions may be helpful. Your first step of caustic-soda-reverse-current is probably too strong and precipitates a black smut on the solder over which you cannot plate; use a weak alkaline cleaner for this step, eliminating the reverse current. If the parts are not too greasy, this should be sufficient for a cleaning cycle. A momentary dip in concentrated muriatic acid after your step three is sometimes helpful. Finally, try flashing the parts with copper, if you have it, in place of your step six. If not, use the brass solution, taking the voltage to the maximum for approximately a minute then cut it back to the regular plating voltage.

Plastic Plating

Question: I wish to inquire about the plating of pieces made of plastic. Do you have any formula for the treatment of plastic pieces before they are plated? If so, how can I obtain this information? And I would be pleased to know if you can tell me why my acid copper gives a very rough deposit. To give the pieces a heavy deposit they come out of plating solution almost like sand paper. Would there be too much copper in solution? When made there was 27 oz. copper chloride—6.5 oz. acid.

They seem to say you cannot use a cyanide copper solution on plastics because of the treatment these pieces are given before plating. If you can give me any information on this subject or where I can get it I would be pleased to hear from you.

C. A. S.

Answer: A thorough treatment of plastic plating is covered in a book, "Metallizing Non-Conductors," by Samuel Wein. The price is $2.00 per copy and the book may be obtained from the *Metal Industry Publishing Co.*, 11 W. 42nd St., New York 18, N. Y.

Your acid copper undoubtedly has considerable particles and impurities in it. Transfer filtration, cleaning out the tank, boiling and scrubbing the anodes, and chemical control of the solution should bring you out of your trouble.

Acid copper is used for plating on plastics. However, cyanide copper may be used after a conducting film of silver or copper—the silver by reduction and the copper by acid baths—is applied. This is because the cyanide attacks the plastic surface.

Chromium Plating

Question: After reading "Health Hazards in Chromium Plating" by J. J. Bloomfield and W. Blum (U. S. Government Printing Office, 1928) we hesitate to install chromium plating in our shop. Can you inform us of any methods or literature on these methods which might supercede this literature or make it obsolete?

W. W. G.

Answer: By no means should you consider chromium plating under proper conditions enough of a health hazard to refrain from installing the bath. With proper exhaust facilities, there is no danger to personnel; to obtain information, write to a reliable exhaust equipment manufacturer or to your plating equipment supply house.

Black Finish on Silver

Question: I am interested in a Black Finish to be used on Silver Oxydize and Antique Finishes. Can you supply me with any information in regards to a Black Finish wherein the drug Butter of Antimony is used. I might add that this is not an immersion solution. It is used with current.

W. J. E.

Answer: Antimony Trichloride or Butter of Antimony is only occasion-

ally used for bluish-gray deposits because of the explosive nature of antimony precipitates—they explode if the vessels in which they are kept are cracked, or if they are struck a hard blow. A platinum chloride solution may be rubbed or brushed on the objects, producing a beautiful, deep black color. Use 1 gram platinum chloride dissolved in ¼ liter of water, adding ⅛ liter of ordinary alcohol.

Zinc Alloy Cleaning

Question: We are manufacturing children's watches out of a Zinc alloy of the following composition—

Zinc	95.7%
Aluminum	4%
Magnesium	.3%

but are unable to obtain a high gloss which is essential for these goods. Could you please advise us what procedure is to be followed to obtain such a high glossy finish?

J. G. L.,
Melbourne, Australia

Answer: Apparently your buffing, coloring and cleaning prior to final finishing operations are at fault. In order to get a final high lustre, buffing should be done with tripoli on cloth wheels. In general, the number of stitches in cloth wheels governs the hardness of the wheel, and the flatter the surface the harder the wheel may be. It is essential that the tripoli be free cutting, since excess pressure results in dragging and waviness, particularly in rolled zinc. Peripheral speeds of about 8,500 feet per minute may be used if the parts are die castings; a speed of 5,000 to 6,000 feet per minute is best for rolled zinc, and may be adjusted to the diameter you are using. In coloring for the high luster, cloth wheels using a dry, soft compound should be used. The compound should be dry and free from lime; excess grease makes cleaning difficult and the presence of lime makes both cleaning and rinsing harder. Frequently, the buffing and coloring are both done on the same wheel. This is done by using unstitched cloth buffs in the thickness of 10 to 12 inches all assembled on the same shaft. Generally the tripoli operation is done on the right hand half of the wide buff and the coloring operation using a soft, dry compound on the left half; in this manner, the entire operation of buffing and coloring can be done using the minimum number of strokes.

In cleaning, some form of solvent treatment is desirable as a preliminary step. Trichlorethylene is widely used as a vapor and a rinse for this operation. Kerosine and gasoline deposit heavy hydrocarbon residues during evaporation and should not be used, for the film is not easily removed by alkaline cleaners. The alkaline cleaner used should be carefully selected; too strong a cleaner dulls the surface and causes blistering in subsequent plating operations; too weak a solution will not remove grease and dirt. Excellent proprietary cleaners specifically designed for zinc are available, and the equipment, method, etc., should be rigidly followed. After proper cleaning, an acid dip should be used to neutralize films of alkaline salts left by the cleaner. Generally, sulfuric acid in concentrations of 5% is used in this dip. Time required is a simple immersion and is in the order of 5 seconds. The usual practice is to immerse the work until evolution of gas bubbles has just started. This insures that the materials left by the cleaner are neutralized and removed. Subsequent operations of plating may be performed in the usual manner. The matter of the alkaline cleaner is most important for all the effort spent in obtaining a high lustre in the buff and color operations may be neutralized by improper cleaning. If a proprietary zinc cleaner is not available, 4 to 6 ounces per gallon of trisodium phosphate may be used. Use at about 180 degrees F and operate as an electrocleaner, making the work the cathode with sufficient current to cause copious gassing. Frequently two such tanks are used; one, the initial, as a soak, and the other as the electrocleaner. In this fashion, the electro cleaner is not contaminated so rapidly. Time in the electrocleaner varies from 15 seconds to a minute; this must be determined by test for your alloy.

Embrittled Plating

Question: I am having trouble. After my work stays in stock for a month or so, plate starts to crack right from the base metal, especially when lighter is engine turned. Base metal is brass, flashed in Rochelle Copper, then nickel plated. Could this season cracking apply to my cracking of plate?

A. A.

Answer: The trouble you are experiencing in season cracking may well be hydrogen embrittlement. By baking several finished parts at about 300 degrees F. for about an hour or longer immediately after removing from the plating cycle, thoroughly rinsed and dried of course, you can compare with those parts that have cracked. This should correct this condition.

PROFESSIONAL DIRECTORY

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Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Special Heavy Duty Lead Anodes

The widespread appearance of massive bumpers and grillwork on the post war automobile has thrust new

problems in the lap of plating engineers.

The lead anode pictured is part of this development. It is reputed to be one of the largest in the industry. It is not only taller than the man beside it but heavier.

This and others like it are designed for the large plating tanks now found necessary for fast plating of heavy metal work. These anodes come with special hooks for hoisting in and out of tanks.

Because of their patented sawtooth design and size the anodes are said to have better throwing power as well as several times the current carrying capacity of standard anodes which have been used previously.

Heil Process Equipment Corporation, Dept. MF, Cleveland, Ohio, is the manufacturer.

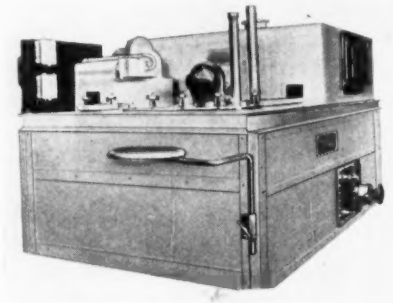
Small Parts Washing Machine

A new machine has been developed by the Mabor Company of Clark Township, Rahway, New Jersey for the processing of ball bearings. It lays particular emphasis on the difficult problem of cleaning the hidden areas of the races.

The variable speed conveyor of the equipment is a link chain affair, wound around a series of sprockets supporting vertical pyramidal holders which accommodate the ball bearings. The races are rotated continuously by means of the friction strap and the eccentric sprays which are directed between the two races. These sprays are actuated by two 2-H.P. pumps.

The equipment may be used with any spray treatment, utilizing one, two or three different sprays. From 1500 to 3000 ball bearings, in sizes up to 6" in diameter, can be handled per hour in the machine and more with alterations. Loading and unloading in some cases can be made automatic. A blow-off and dryer attachment can be furnished, if specified.

The solvents used are emulsion or oil base cleaners, such as kerosene or similar compounds to prevent the pos-



sibility of rust formation. The solvents are also continuously filtered to eliminate the return of harsh abrasives which are damaging to the units being processed.

The same equipment can be utilized for production runs of other parts, with or without rotation under sprays, and with or without blow-off and drying.

For additional information, quotations, engineering data, etc., write to the Mabor Company, Dept. MF, Clark Township, Rahway, New Jersey.

Gun Bluing Process

A new proprietary bath for bluing guns has recently been developed by Protective Coatings, Inc.

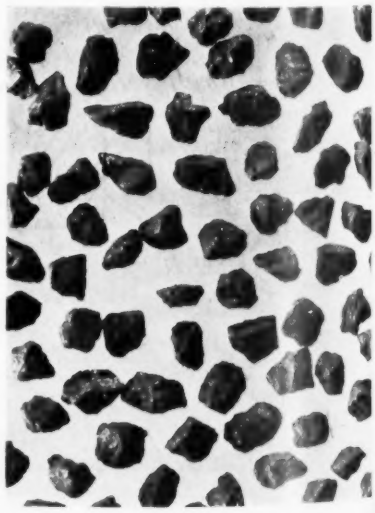
The process is stated to be the only low-temperature bath for obtaining blue-black coatings on gun metal parts. The operating range is said to be from 260 to 295 degrees F. Included with the process are tanks and other necessary equipment. The cycle consists of cleaning, hot rinsing, treatment in the oxidizing bath for 15 to 30 minutes, cold and hot rinsing and immersion in a finishing oil bath. It is also claimed that the bath will not dissolve solder and that cast iron can be blued at 295 degrees F.

For further information write Protective Coatings, Inc., Dept. MF, Box 3985, Detroit 27, Mich.

Polishing Wheel Grain

The Exolon Company has developed and is marketing in all standard polishing grades 20 to 120 inclusive a maroon-red coated aluminum oxide abrasive grain for use with hot glue or cements in set-up polishing wheels for the metal trade. It is the special and distinctive surface treatment which makes this grain so effective, particularly with a hot glue set-up, it is claimed.

The surface treatment of aluminum oxide abrasive grain for the polishing industry has been standard practice in the abrasive industry for a number of years. This surface treatment, or tenacity treatment as it is called, was developed to enhance the capillarity



of the grain surface to induce greater adhesion of the glue to the surface, and thus insure greater strength of the head of a polishing wheel.

One typical method was to dip the abrasive grain in a slurry of clay suspended in water, to let the mass drain and dry, then to heat the mass to partially melt the clay into the surface. This method produced a surface coating of droplets of fired clay which appeared as protuberances when the surface was examined under a microscope. This surface treatment was said to be effective in enhancing capillarity but had two weaknesses. One, the coating enlarged the grain size almost one grade, for example a 90 grade was coated to make an 80 grade; and two, the minute protuberances had a tendency to rub off in handling and shipping, causing the grain to become dusty. This dustiness when excessive prevented good glue adhesion, making for a poor conditioned head which readily shed in service.

Another method of manufacture was an etching process which attacked the surface, particularly the slag or interstitial glass. The method was effective in producing better glue adhesion but the grain itself was weakened, causing undue fracturing of the grain in service.

With these methods in mind and aware of their essential weaknesses, the technical staff of The Exolon Company set out to produce a surface-treated abrasive grain which would overcome these weaknesses. The problem was turned over in detail to the Fellowship maintained by The Exolon Company at the New York State College of Ceramics, Alfred, New York. After three years of effort and the trying out and rejection of over 300 tests, the simple coating process considered acceptable was ready for pilot-plant operation. In June 1944, the first pilot-plant operation was run. The field tests were satisfactory and a full scale plant was designed and erected by the spring of 1945. This full scale plant has been in continuous operation since that date producing the product known as Exolon RST.

The characteristics of Exolon RST are claimed to be: one, the maroon-red coating is microscopically thin, uniformly covering the whole surface, so thin in fact that a coated grade size remains the same as before coating and need not be regraded; two, the glue adhesion is enhanced threefold over the uncoated grain; and three, the grains are stronger by actual test, approximately 20% stronger.

Patents are applied for, covering this new development.

The same coating has been used in the development of a special grain for resin-bonded grinding wheels and rubber-bonded cutoff wheels, also for a distinctive grain used in the production of abrasive coated paper and cloth belts and sheets and paper and cloth fibre abrasive discs.

For information and specifications, write The Exolon Company, Dept. MF, Tonawanda, N. Y.

Diamond Grit for Finishing Operations

The Magnus Chemical Company's Industrial Processing Division, at Garwood, N. J., announces the development of a new technique for the application of diamond grit to the full range of finishing operations where this polishing medium should be used. This new technique, which utilizes colored, pre-mixed diamond compounds available in tube or stick form, should materially expand the usefulness of diamond lapping.

The efficiency and speed of this superfinishing technique is said to be demonstrated in a wide range of applications. Following are some claims made for this product: the life of carbide or steel cutting tools can be increased 3 to 6 times; any shaped molds and cavities for steel, plastic, glass, etc. are quickly mirror finished and kept in better shape; plug gauges, punches and other cylindrical surfaces are quickly and simply superfinished; production parts of any kind can be processed to any degree of finish; rolls for all types of foil and sheet, from aluminum to silver to steel can be

CORROSION RESISTANCE
That's more than skin deep

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IS

NOT A LINING
NOT A COATING

but a Structural,
Non-Corrosive Material
ALL THE WAY
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Scratch the surface—or gouge out a chunk—and you'll still find HAVEG process equipment fully resistant to the attacks of corrosion. Haveg is resistant to practically all acids, bases and salts, as well as chlorine, many solvents and other chemicals.

Haveg equipment, either standard or built to order, is adaptable for tanks, blowers, agitators, valves, piping, pumps, towers, coolers, fume ducts, hoods and many other shapes.

Send for our Bulletin F-4 with complete engineering and application data.

HA-3-47

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CLEVELAND CHICAGO DETROIT LOS ANGELES

refinished while in place in the mill; dies of all types and shapes are easily and quickly mirror finished.

Precision graded diamond grits are provided in scientifically proportioned compounds ready for instant use, which contain the proper percentage of diamond for each grade size. These compounds, supplied in eight particle sizes from approximately 120 microns, for extra coarse cutting, to approximately 1 micron, for super high micro finishing, are available in two forms. One is the stick form about the consistency of lipstick. The other is in paste form in a tube. Either type is claimed to insure speedy and economical application. Each tube or stick is supplied with a case hardened steel roller for applying and spreading the compound.

The ultimate improvement which puts diamond lapping on a completely precision basis is the development which puts color to work in these operations. Instant identification of the right grit size, precise use of the proper compounds in the most effective sequence and an end of mistakes and wastage is insured by using distinctive colors to identify each grade. Not only the tubes and sticks but each grit size is identified by color in the compound itself. The eight grades of particle size are given eight individual colors. The rollers for each grade are also individually colored to match the grit and tube or stick for which it is supplied.

The Magnus diamond lapping kits are available in tube or stick form in any desired combination of grit sizes. In general, the eight grade kit provides the complete range of sizes to cover all possible finishing operations and is recommended for those plants whose finishing programs cover a wide variety of operations, calling for the full range of grades. For most plants, however, the six grade kit will be found to be suitable, since it provides a range and sequence of grits which will meet their requirements.

Complete information and descriptive bulletins of the Magnus Superfinishing Compounds in the shop may be obtained by writing direct to the Industrial Processing Division, Dept. MF, Magnus Chemical Company, Inc., Garwood, N. J.

Skin Irritations

Letters on Tarbonis Cream are said by The Tarbonis Company to testify to its value against irritants which cannot be avoided in metal finishing. The following are claimed to be excerpts from some of these letters:

"Employee bothered with skin irritation from caustic cleaning solution or bright nickel solution . . . irritation practically healed . . . also wonderful for chromic acid burns." "Best remedy we have yet used in one of the worst cases of cyanide itch." "Gave remarkable results in drying up a bad nickel itch type rash." "Proved very satisfactory in counteracting skin irritations caused by various types lubricants . . . especially efficacious in treating irritations from sulphur-based cutting oils."

The manufacturers state that Tarbonis is pleasant, odorless, greaseless and stainless—will not soil hands, clothing or the work. It is also explained that the material is not only a treatment but proves effective as a protective against many irritants.

A good sized sample jar and literature are available to readers on request. Address The Tarbonis Company, Dept. MFR, 4300 Euclid Ave., Cleveland 3, Ohio.

Synthetic Detergent

A new synthetic detergent for use in washing compounds for metals has recently been announced by Alrose Chemical Company.

Entitled Alrosene 31, the detergent is a modified alcohol sulfate with 31% active ingredients. It is claimed a 1% aqueous solution will remain clear in the presence of calcium, magnesium and many heavy metal salts at temperatures over 38 degrees C. It is also said to show no reduction of foaming in hard or sea water, alkali or acid and is compatible with soap and shows no decrease in foaming when compounded with soaps. Wetting properties are stated to be unaffected by the presence of neutral, acid or alkaline electrolytes up to 5% concentration.

To obtain technical information and other data, write Alrose Chemical Company, Dept. MF, 180 Mill St., Cranston, R. I.

Chromium Plating Bath Blanket

The Udylite Corporation of Detroit, Mich., manufacturers of supplies and equipment for electroplating and similar operations, approached The Dow Chemical Company for guidance in working out an idea. Together with

Dow engineers they developed Chrome-Lock Tubes.

These plastic tubes, closed at each end to resemble miniature pillows, are floated on the chrome bath solution in sufficient depth to blanket the bath and thereby lessen considerably the escape of the fine spray. The lightweight tubes are said to move apart easily when a rack of objects which are to be plated is lowered into the solution; they move back into place around the rack spine, completely covering the acid bath while the objects are being plated.

The simplicity of the blanket is shown by the accompanying picture, which was taken at Electro-Finishing Industries, Incorporated, Detroit, Mich., one of the many users of this technique. The tubes are simply dumped into the chrome plating tank in sufficient number to form a blanket of the desired thickness. The thicker the surface blanket of the tubes, the less chromic acid loss, it is stated. About one and one-half pounds of the tubes are necessary for a one-inch blanket over one square foot of solution surface, and three pounds per square foot for a two-inch blanket.

While the styron tubes save from 50% to 75% of the chromic acid ordinarily lost, the protection it gives plating room employees is also an immense advantage, it is claimed. Experiments and utilization are said to

have proven that additional compensations to the user of these tubes include a need for less heat to keep the bath at the correct operating temperature, and a saving of heat and electric power in the plating room by cutting down on the quantity of air withdrawn by the blower.

Styron was chosen as the plastic material from which the three-inch-long Chrome-Lock Tubes are extruded because of its exceptional resistance to acids and alkalies, and because, like most plastics, it is lightweight and smooth textured. The tubes are not changed in size, weight, appearance or chemical composition by immersion for days in the chrome plating bath, which is so highly acid.

In addition styron is shatterproof, thereby preventing loss of the tubes by breakage. Replacement is necessary only when the tubes are lost by drag-out, for styron itself will stand up indefinitely in the acid.

Mild Alkaline Cleaner

Optimus No. 100, a new cleaner, has just been announced by Optimus Detergents Company, Dept. MF., 104 Water St., Matawan, N. J., manufacturers of industrial cleaning materials.

A white, free-flowing powder, Optimus No. 100 is said to be completely soluble in hot or cold water. It is a balanced blend of mild alkaline materials, including special water softening ingredients and is free rinsing and at low concentrations is soft on the skin, according to the manufacturer.

An important application of this new product is in power spray washing machines. Here it is used at concentrations of ½ oz. to 2 oz. per gallon at temperatures from 130° F. to boiling. It is claimed to be very effective in removing light oils, grease and dirt, and may be used on ferrous or non-ferrous metals.

Electrocleaning with the new material is carried on with good results, it is stated, where a cleaner of highly stable electrical conductivity is desirable; it has a long life for such purpose.

Tarnish Resistant Addition Agents

A series of addition agents for silver and gold solutions to improve tarnish resistance and hardness are now available on a nationwide scale, according to Granium Products.

Granium "B", the addition agent for silver solutions, is said to be a complex precious metal salt. When added to the average silver cyanide bath, it is claimed that harder and tarnish resistant coatings are obtained. Additions of 15% to 75% Granium may be made, depending upon the degree of hardness desired; 25% Granium to 75% silver is recommended for average plating operations. No extra work is involved in making the additions, it is stated, the amount of addition agent desired being merely added to the bath and plating continued as formerly. For replenishment of the complex salt, Granium-silver anodes in the ratio of 25% to 75% are available.

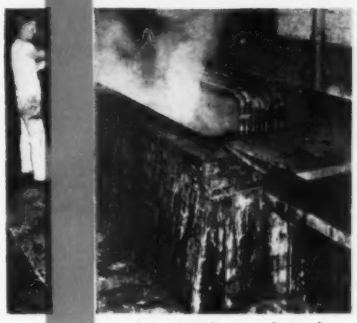
Granium "G" Goldtone is designed for use in gold plating solutions. This material is supplied in anode form only. The solution is built directly from the anode by placing it in a regular gold cyanide solution and passing current through the bath until the solution becomes saturated. Upon saturation, the deposit will be the same color as the anode, it is stated, although the color can be varied by means of Granium "B" salt additions. Both salts are claimed to eliminate the necessity of other coatings for gold and silver tarnish resistance.

For more complete information write Granium Products, Dept. MF, 2616 Downey Road, Los Angeles 23, Calif.

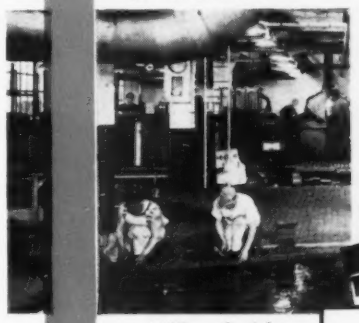
General Purpose Cleaner

A new general purpose inorganic cleaner, designed for maintenance work but suitable for numerous other uses, has been announced by the Penn-

These ACID- and ALKALI-PROOF Materials of Construction Don't *COMPROMISE* With CORROSIVES!



Atlas Pickling tank in shop of large Eastern galvanizer. Concrete, lined with Atlas-tiseal and brick, joined with *Tegul*-VITROBOND.



8000 sq. ft. Atlas heavy duty plating room floor in 5th floor of radio manufacturing plant. To date — seven years without "down time."

They're not merely "resistant" — they're PROOF against acids and alkalis.

ATLAS Materials of Construction — cements, plastic linings and protective coatings — give the immunity you've wanted against acids and alkalis, concentrated or dilute, also corrosive salts, fats, oils, solvents, steam and water. ATLAS Construction does away with "down time".

Contact the nearest Atlas representative. Let him show you how corrosion problems are solved—permanently. Our Engineers are ready to study your problem and to make recommendations, plans and estimates—without obligation on your part. Write Mertztown office for Bulletin T.D.-5.

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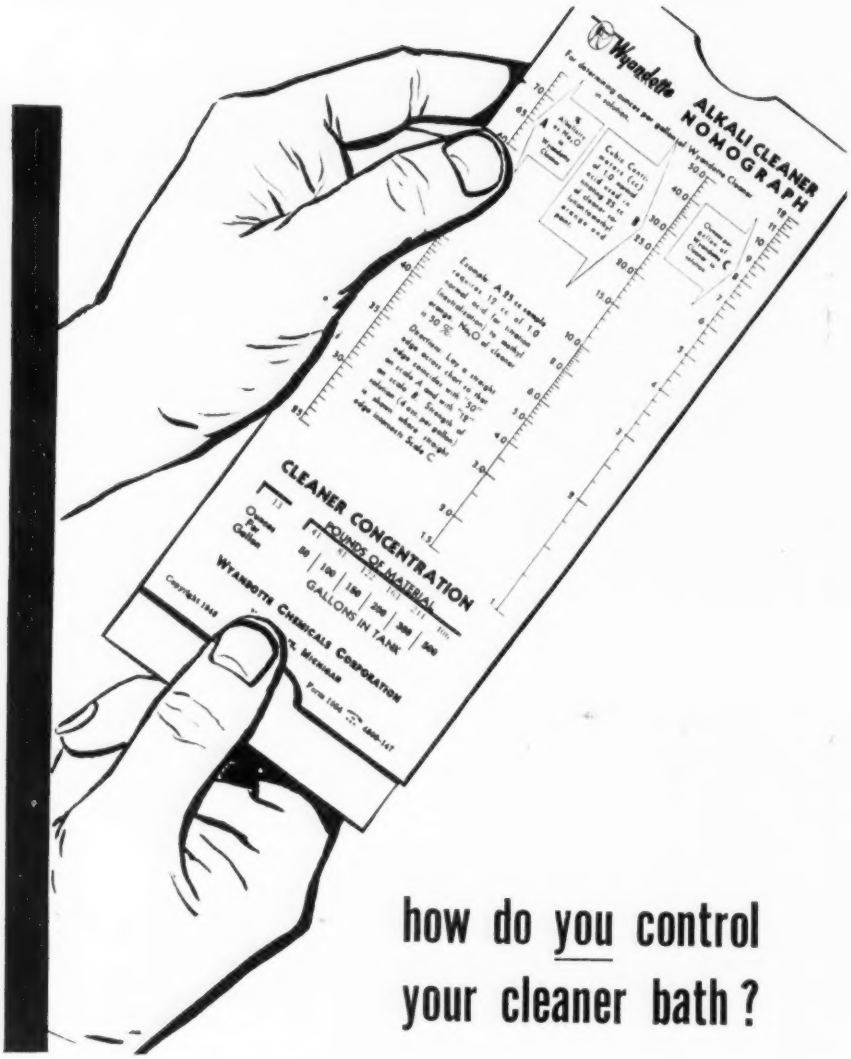
IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal, P. Q., 86 Bloor St. W., Toronto, Ont.



how do you control your cleaner bath?

SIMPLIFYING operations increases efficiency. That's what the new Wyandotte Nomograph does for control of alkaline cleaner solutions.

The Wyandotte Nomograph eliminates complicated calculations. Knowing the total alkalinity, you can determine quickly the amount of cleaner present by means of a simple titration—using standard laboratory apparatus. Your answer is in ounces per gallon—no more time-taking conversion computations!

In addition, one side of the Wyandotte Nomograph permits you to calculate the number of gallons in the tank . . . the other shows how many pounds of material are required to make up solutions of various concentrations.

Mail the coupon today for this up-to-date means of controlling the total alkalinity of cleaner baths!

Wyandotte
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WYANDOTTE CHEMICALS CORPORATION
Room 104, Industrial Dept., Wyandotte, Michigan
Please send me, without charge, a Wyandotte Nomograph.

Name _____ Street _____

City _____ State _____

sylvania Salt Manufacturing Company.

The new cleaner, designated Pennsalt MC-1, is a dry, granular inorganic material that is said to dissolve quickly in water, removes most types of soil easily and rinses rapidly. It is not a soap nor is soap necessary with its use.

For industrial use, Pennsalt MC-1 may be used in steam gun cleaning of painted or unpainted surfaces. Two to four pounds of the cleaner is claimed to be adequate for 50 or 55 gallon tank of the vapor spray machines.

In tumble barrel cleaning, burnishing or de-burring operations the recommended mixture is from two to eight ounces for a gallon of water.

The material can be used for metal preparation where a heavy duty cleaner would be too strong. The new cleaner is mild enough not to harm either clothing or skin and acts as a water conditioner and soap saver.

Packed in 125 or 250 pound plywood drums, Pennsalt MC-1 is being sold, following extensive field and laboratory tests, by the Special Chemicals Sales Division, which also handles Pennsalt's heavy duty metal cleaners, solvent type cleaners and corrosion-proof cements and paints. A four-page color leaflet may be obtained from the Company by writing to 1000 Widener Bldg., Dept. MF, Philadelphia 7, Pa.

Rubber Vulcanizing Process

A new patented process for vulcanizing rubber on various base products is announced by the Latex Seamless Products Company.

The process uses rubber or synthetics for acid or alkali buckets, metal tanks, lined fittings, plating racks, blowers and fans, dipping baskets.

Write Latex Seamless Products Company, Dept. MF, 657 E. 61st St. Los Angeles 1, Calif.

Business Items

Goble Joins Lea in Sales Research

The recent appointment of *Sherman M. Goble, Jr.*, to perform sales research for the *Lea Manufacturing*

Sherman M. Goble, Jr.

Company, Waterbury, Conn., has recently been announced.

Mr. Goble was formerly with the *McGean Chemical Company*, Cleveland, Ohio; the War Production Board, Nickel Section; and with the *Seymour Manufacturing Company*, Seymour, Conn.

Great Lakes Plating Financial Statement

Net income of *Great Lakes Plating Company* increased to $133,262 for 1946 from $115,205 for 1945, *T. M. Drever*, president, disclosed in the annual report issued recently. Earnings were equal to 67 cents a share on the 200,000 shares of stock presently outstanding, against 58 cents a share for 1945.

Sales were the largest in the company's history, advancing to $1,846,316 from $1,583,001 in 1945, a gain of 16.6 per cent. "Orders to date in 1947 are running ahead of the corresponding period for last year," Mr. Drever reported. "The volume of business we can anticipate for 1947," he said, "will depend largely upon the level of industrial activity in general."

"Important progress was made," stockholders were told, "in an extensive plant modernization program, involving basic changes in plant layout, installation of new equipment and improvement of working conditions. This program will result in more efficient operation and improved service and quality for our customers." The program, involving a total estimated expenditure of $150,000, is scheduled to be completed in August, this year.

During 1946 the company operated continuously two eight-hour shifts, six days a week, without any strikes or work interruptions, Mr. Drever said. Difficulty was encountered, he noted, in hiring and retaining employes. At the same time, increased costs and shortages of materials were "major problems."

The Dec. 31, 1946, balance sheet showed a strong financial position, with current assets of $580,162 against current liabilities of $145,544, a current ratio of 3.9 to 1.

Ehret Gets Electric Products Company Appointment

Mr. Gordon J. Berry, vice president and sales manager of *The Electric*

Robert H. Ehret

RACK COATING CUTS WASTE 50%

Unichrome Coating 202 Saves Costly Plating Solution!

When this plater sent his 202-coated racks through the plating cycle (which included nickel and rhodium) there was *less treeing, less dragout* — and rhodium consumption was actually cut in half! Why? Because the coating did not chip when contacts were cut — and there was no flaking or damage during hard use.

If you want the utmost in rack coating life — even in chromium or hot cyanides — consider what this service record means. It proves that Coating 202 is really *tough* — will take rough shop handling as well as the severe plating solutions it was designed for. Write your nearest Unichrome office for full details.

UNICHROME

Trade Mark Reg. U.S. Pat. Off.

RACK COATINGS—Products of

UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.

Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 11, Cal

RUBBER
HEILEX
LEAD
KOROSEAL
CERAMICS OR ALLOYS
LININGS
TO FIT THE JOB
Heil Process Specialists have no soft spot for any single lining or insulating material. They know that temperature, abrasion, absorption and contamination are factors that affect all choices. They recommend and supply the lining best suited to the needs of the process. The lining is installed separately or as part of the complete job.
Heil experience in chemical proof construction includes the fabrication, lining, coating and assembly of all types of tanks, ducts, tank heaters, linings and fixtures built to your specifications. Complete job, one cost, one responsibility, one delivery date. Write for Bulletin.
HEIL PROCESS EQUIPMENT CORP.
12901 Elmwood Avenue • Cleveland 11, Ohio
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INDUSTRIAL FINISHING EXPOSITION
JUNE 23-27, 1947
HEIL CHEMICAL PROOF EQUIPMENT
ANODES • TANKS • DUCTS • TANK FIXTURES
• HEATERS • COATINGS • LININGS . . .
fabricated to your specifications

Joseph F. Hart

Products Company, 1725 Clarkstone Road, Cleveland 12, Ohio, announces the appointment of *Robert H. Ehret* to the position of assistant sales manager.

Mr. Ehret will be responsible for handling headquarters sales negotiations. He joined The Electric Products Company November 1, 1945 after 14 years of selling, applying and installing apparatus for prominent electrical manufacturers.

Cee-Bee Promotes Two Chemists

Promotions for two chemists at *Cee-Bee Chemical Company*, Los Angeles manufacturer of specialized cleaning materials, have been announced by *C. D. Black*, executive vice-president.

Keith Whitcomb has been made technical director and *Joseph F. Hart* has been advanced from technical director to manager of Cee-Bee's new department of sales engineering.

Whitcomb, member of American Society for Metals and American Chemical Society, was research chemist for *Ryan Aeronautical Company*, San Diego, and chief chemist of the Marine Air Corps station at El Toro, California. He has developed three important time-savers in aircraft cleaning since he joined Cee-Bee as research chemist in September, 1946—an integral fuel cell stripper, a paint stripper and an aluminum cleaner and brightener. The successful use of the spray-on chemical he developed for removing sealant from integral fuel cells has simplified one of the nastiest jobs in aircraft overhauling.

Hart, an active member of the American Chemical Society and the American Electroplaters' Society, has been working in industrial chemistry for twenty-three years, going from pure research to the practical application of scientific principles to specialized cleaning and processing problems. He was a research chemist for *Parke Davis* and testing engineer with the U. S. Bureau of Standards, and was chief chemist of *Kelite Products, Inc.*, during the period of that company's greatest growth.

His creative work with non-critical, free rinsing metal cleaners has resulted in impressive savings in time and labor. As head of Cee-Bee's department of sales engineering, Hart will go out into the field to assist manufacturers in setting up production line cleaning operations to develop materials and processes to fit specialized needs and to provide technical assistance for Cee-Bee salesmen. He will also be responsible for training the company's new service engineers.

Nelson Appointed By Gripmaster

Appointment of *Morie Nelson* as Director of Sales of the *Gripmaster Division* has been announced by *Nelson Chemicals Corporation*, 12345

Morie Nelson

Schaefer Highway, Detroit, Mich.

In his new capacity, Mr. Nelson will supervise sales and sales promotion for *Gripmaster Polishing Wheel Cement*.

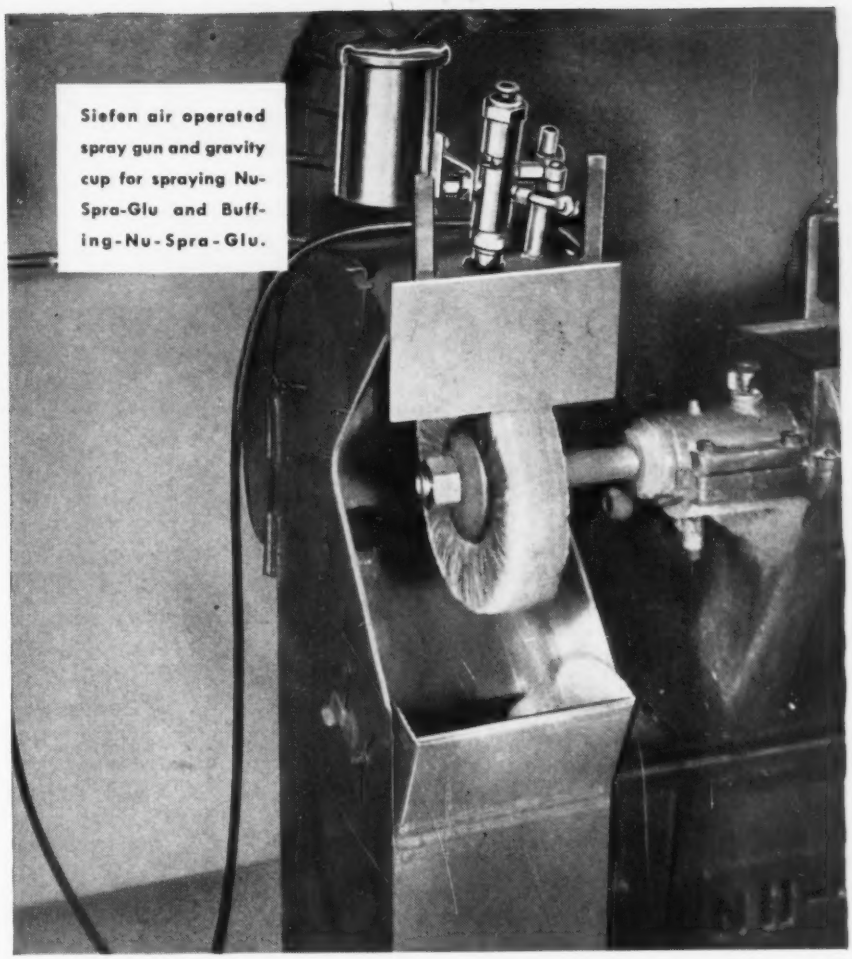
Prior to joining the armed services in 1943, Mr. Nelson was in charge of sales promotion on heavy chemicals for *Michigan Bleach & Chemical Company*, predecessor to Nelson Chemicals Corporation. Upon leaving the army in late 1945, Mr. Nelson was made assistant director of sales on Gripmaster, which position he held until his present appointment.

Further additions to the Gripmaster sales staff are being made to better handle the widened distribution of the product which now is sold in the United States, Canada and 17 foreign countries.

Wyandotte Chemicals Representatives Hold Rrefresher Clinics

The representatives of the *J. B. Ford Division* of *Wyandotte Chemicals Corporation* are currently attending sales and service refresher clinics. *C. B. Robinson*, vice president in charge of sales of the J. B. Ford Division, accompanied by home office executives, is directing a program that covers product "stretching." Clinics are being held in New York, Pittsburgh, Atlanta, Chicago, Kansas City, Indianapolis and Toronto.

When all clinics have been held, the nearly 200 representatives of the Ford Division will have completed a thorough, three day refresher course cov-



FOR SATIN FINISH

Siefen NU-SPRA-GLU

Nu-Spra-Glu is a liquid cold glue and abrasive mixture that dries instantly when sprayed on a revolving wheel. Users claim savings up to half on material costs as compared to greaseless compounds. Grain sizes from 120 to 600.

For mirror finish—Buffing-Nu-Spra-Glu, a grease and abrasive mixture, sprays to wheel, cuts compound consumption in half and buff wear one-third.

See our display, Industrial Finishing Exposition, Detroit —Booth 255.

Latest Information—an authoritative manual on spraying, buffing and polishing compounds—available now!

J. J. SIEFEN COMPANY

5627 LAUDERDALE • DETROIT 9, MICH.

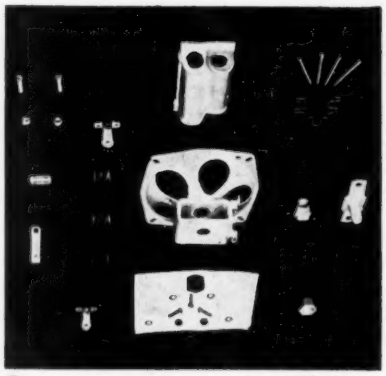
The New Miracle Finish
IRCO-Seal

● The IRCO-IZING PROCESS plus IRCO-SEAL is a complete metal preparation and finish in one operation.

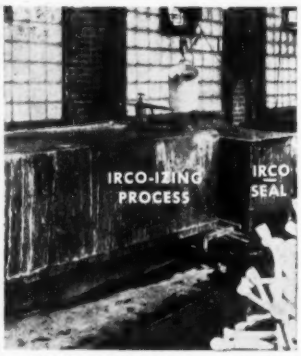
IT SAVES COST AND LABOR • EASILY SET-UP • SIMPLE TO MAINTAIN • IRCO-SEAL CAN BE DIPPED OR SPRAYED.

After the metal emerges from the IRCO-IZING bath, *it need not be dried* before application of IRCO-SEAL.

IRCO-SEAL is a satin-like organic finish, durable, *will not clog threads*, and dries rapidly.



● Above are some articles finished with IRCO-SEAL (Note the smooth finish and unclogged threads) 300 HOUR SALT SPRAY RESISTANCE



The IRCO-IZING PROCESS is a hot zinc phosphate treatment for iron, steel, zinc and cadmium, providing a rust inhibiting phosphate base for all finishes.

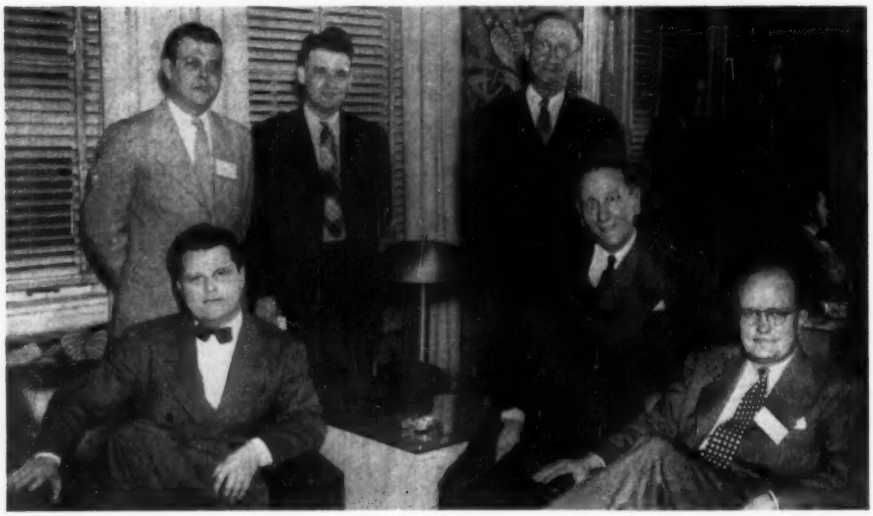
IRCO-SEAL is immediately available in the following colors:

- Bright metallic (Replaces Plating)
- Brown
- Mahogany
- Blue
- Black

INTERNATIONAL RUSTPROOF CORPORATION

IRCO PRODUCTS

CLEVELAND OHIO



Both representatives and managers take an active part in the Wyandotte Chemicals Refresher Clinics being held in the seven sales regions of the J. B. Ford Division of the Wyandotte organization. This photo taken at the Central Region Clinic in Pittsburgh shows left to right the Industrial Dept. representatives who were present: Jack McCarthy, Columbus; Earl Soop, Technical Service Dept., Wyandotte; Charlie Chalfant, Dayton; John Rowan, Pittsburgh; Tom McHugh, Cincinnati; Evans Schmeling, Ass't Manager, Industrial Dept.

ering their service methods and equipment. These "shirt sleeve" sessions are said to help insure customers the most for their money from the service angle.

Progress of the Wyandotte Chemicals $25,000,000 expansion program is reported at each clinic by a management executive. During the sessions service instructions regarding the newest metal cleaner, *Emlon*, were thoroughly checked.

Herman Frahme Joins U. S. Stoneware

Herman H. Frahme

Herman H. Frahme, who resigned as plant superintendent and plant manager of Chemical Equipment Division, *General Ceramics and Steatite Corporation* to become vice-president of *Northwestern Terra Cotta Corporation*, will serve *U. S. Stoneware* as consulting ceramic engineer, according to an announcement by *Howard Farkas*, vice-president of U. S. Stoneware.

Mr. Frahme is a graduate of Rutgers University with a degree of Bachelor of Science in Ceramics. He is a member of American Ceramic Society, New Jersey Ceramic Association and Phi Lambda Upsilon, honorary chemical fraternity.

Osborn 20-Year Meeting Is Evening of Surprises

The annual meeting of *Osborn Manufacturing Company's* 20-Year Club, in Hotel Cleveland, March 29, ostensibly called to honor eleven new members who just reached their 20th year of service with the Cleveland power brush manufacturer, turned out

Franklin G Smith (left) president, The Osborn Manufacturing Company has presented more than 100 watches to company employes who have attained 20 years of service, but this year at the annual meeting of the 20-Year Club the tables were turned. C. W. Titgemeyer (right) president of the club, is shown presenting a watch to Mr. Smith, the first one he has received during the 55 years he has headed the Company.

to be an evening of surprises for both employes and management.

The first surprise of the evening came after *President Franklin G. Smith* finished awarding watches to the new members, in accordance with the company's annual custom. *C. W. Titgemeyer*, president of the club, turned the tables on Mr. Smith and awarded him a watch, gift of the club membership, "to commemorate his 55 years of service with the company and having been overlooked so far during the watch presentations."

Mr. Smith furnished the final surprise, however, with an announcement that all company employes who had 25 years of service with Osborn would from now on be awarded an extra week's vacation, making a total of three each year. He then presented each of 20 employes who had attained 30 years or more of service with individual checks for $500 each.

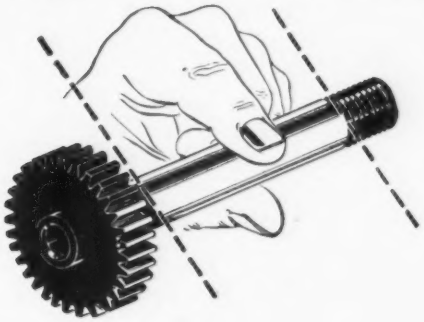
Osborn's 20-year Club has a membership in excess of 100.

Du Pont Engineer Wins Young Author Award

Norman Arnold Nielsen, metallurgical engineer in the *Engineering Research Laboratory* of the *Du Pont Company's* Experimental Station, Wilmington, was presented the 1946 Young Authors Prize of the Electrochemical Society.

The award, given annually to authors under 27 years of age for the best technical paper in the year's publications of the society, was presented at the spring meeting of the society now in session.

UNICHROME Stop-Off Compounds



help you do the fastest job on complicated shapes

DIPPED ON—these easily melted, waxlike materials speed production of your work with sharp edges or complex shapes. Coatings withstand severe plating solutions and cleaners; won't contaminate the bath.

HARDEN AT ONCE—so coatings can be built up to any thickness desired on the double-quick.

EASILY REMOVED—by heating the work or immersing it in boiling water, depending on compound used. Melted compound can be reclaimed, so you save money as well as time.

Stop-Off 311 (Black)—For toughest cycles, including high temperature baths, boiling cleaners. Won't soften below 245F. Remove by heating or by solvent.

Stop-Off 314 (Brown)—For moderate temperatures. Won't soften below 160F. Remove by immersing in boiling water.

Stop-Off 315 (Brown)—Doesn't soften below 180F. May also be used to adjust working range of 314. Remove with boiling water.

UNICHROME

Trade Mark Reg. U. S. Pat. Off.

STOP-OFF COMPOUNDS—Products of

UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.

Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 11, Cal.

Nielsen was co-author with *Dr. E. M. Mahla*, group supervisor of the materials of construction section at the Du Pont Experimental Station, of *Passivation of Stainless Steel*, the prize-winning paper.

Their study, among other things, evaluated the various treatments for increasing the resistance of stainless steel to corrosion.

Born in Ipswich, Mass., August 11, 1920, Nielsen attended Hamilton, Mass., High School, and was graduated cum laude from Harvard University in 1942, receiving a bachelor of science degree in chemistry. He joined Du Pont, soon after being graduated, in the materials of construction section of the Engineering Research Laboratory at the Experimental Station.

Harris Appointed by U. S. Rubber

Richard P. Harris of Norwalk, Conn., has been appointed factory manager of the electroforming department of *United States Rubber Company* at Detroit. He was formerly assistant to the factory manager, *Chance Vought Division of United Aircraft Corp.*, Stratford, Conn.

Mr. Harris was graduated in me-

TICKETS
all One Price
ALUMINUM
COPPER
BRASS
STEEL
PRECIOUS METAL
ONE SOLVENT FOR ALL METALS OR COMBINATION OF METALS
NEW SCIENTIFICALLY IMPROVED
BLACOSOLV
FOR SOLVENT VAPOR DEGREASERS
Now all metals or combinations of metals may be scientifically degreased with the same solvent. You need not pay premium prices for special solvents for different metals. The new, improved BLACOSOLV is the most highly stabilized degreasing solvent for use in solvent vapor degreasers. It can be used over and over again without impairing its high qualities. BLACOSOLV is non-inflammable . . . has a low boiling point (188° F.) . . . Does not affect or stain even the most highly polished surfaces.
Write today for FREE booklet on Degreasers and application with Blacosolv the all purpose degreasing solvent.
G. S. BLAKESLEE & CO.
BLACOSOLV
DEGREASERS AND SOLVENT
NIAGARA
METAL PARTS WASHERS
G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y.
TORONTO, ONT.

H. F. Fulton

chanical engineering from Pratt Institute in 1933 and has held several positions of responsibility in metals fabrication and in industrial engineering.

Cowles Detergent Co. Appoints Fulton

The Cowles Detergent Company, Cleveland, Ohio announces the appointment of *Harold F. Fulton*, better known as "Had" Fulton, as Cowles technical man in the New York State territory to handle sales and service work for the Metal Cleaner Department.

Mr. Fulton is a graduate of Miami University. He has had a wide experience in the metal working industries and during the War was employed by *Allegheny Ludlum Steel Corp.* at its Dunkirk, New York plant.

He is well qualified by education and plant experience to give valuable assistance to the industrial concerns in New York State.

Wood Named Treasurer of Minneapolis-Honeywell

Brison Wood has been elected treasurer of the *Minneapolis-Honeywell Regulator Company*, *Harold W. Sweatt*, president, announced after a directors' meeting here.

Mr. Wood succeeds *Willard L. Huff*, who has been serving as executive vice president and treasurer. Mr. Huff will continue to serve as a director of the company and executive vice president.

Joining Minneapolis-Honeywell in March of 1942 to assist in expediting war production, Mr. Wood was elected assistant secretary and assistant treasurer the following year, which positions he has held until his election to treasurer. A graduate of Yale, class of 1922, he has worked for the *Bemis Brothers Bag Company*, St. Louis, and in the trust department of the *First Trust and Savings Bank* of Pasadena, Calif. Prior to the war, Mr. Wood was associated with the firm of *Coldwell, Banker and Company*, real estate brokers of Los Angeles, until he joined the Honeywell organization.

Pennsalt Transfers Heavy Chemicals Salesman

Arthur F. Bixby, heavy chemicals salesman in the Philadelphia office of the *Pennsylvania Salt Manufacturing Company* for the past nine years, has been transferred to the Pittsburgh office, *George B. Beitzel*, vice president in charge of sales, announced.

Mr. Bixby takes the place of *C. W. Dermitt*, who recently was transferred

to Cincinnati to become district sales manager. In Pittsburgh Mr. Bixby will be associated with *Mr. William Snelsire*, district sales manager there.

Brown Establishes Baltimore Branch

Brown Instrument Company, Philadelphia industrial precision instrument manufacturer, has extended its nationwide program of sales and service expansion to the Baltimore area.

W. J. Law, formerly with *H. P. Rogers*, agent, will be in charge of sales, assisted by *J. F. Maienshein*. Until larger quarters are ready at 1209 E. 25th St., the company will operate from 2100 St. Paul St. Brown and its parent company, *Minneapolis-Honeywell Regulator Company*, will move to the new site about May 1.

Manufacturers' Literature

Variable Rectifier Equipment

A new catalogue recently released by the *Richardson-Allen Corporation* covers the variable rectifier equipment manufactured by the firm.

Explained are the purposes of rectifiers; their electrochemical application covering plating, cleaning, anodizing, descaling, pickling, color plating and general laboratory use; advantages of metal plate rectifiers; engineering specifications; and various industrial applications in the field. Sketches for hooking up rectifiers in individual, series, parallel, series-parallel and series-with-regulator are also given.

To obtain a copy of this attractive catalogue write Richardson - Allen Corporation, Dept. MF, 15 W. 20th St., New York 11, N. Y.

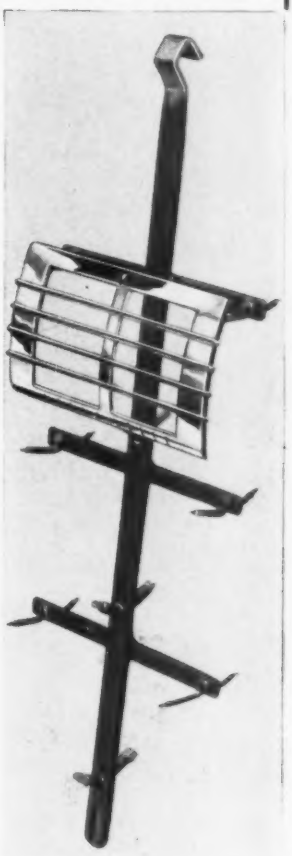
Dust Collectors

A new 20-page booklet completely describing the *Roto-Clone* dynamic precipitator for the collection of dust has recently been released.

Profusely illustrated, the booklet gives applications, specifications, cross-sectional views of various parts of the apparatus, construction details. Included is complete engineering data on performance characteristics as well as a pipe resistance chart, of value when calculating dust collection problems.

To secure a copy of this useful booklet, write the *American Air Filter Company, Inc.*, Dept. MF, Louisville, Ky., and ask for *Dust Control Bulletin No. 272-A.*

Easier to Insulate; Easier to Patch



BUNATOL is the low cost insulation for use on all types of electro-plating racks. It's free dipping and requires a minimum of labor to apply. It has the toughness and resistance for long insulation life and a permanent flexibility which permits insulation of spring contacts.

BUNATOL rack insulation sticks to itself so repairs are merely a matter of cleaning the patch and brushing or pouring on new insulation to complete the repair. The patch makes a continuous film that rinses freely and gives perfect insulation.

May we send you complete information?

NELSON J. QUINN COMPANY, TOLEDO 7, OHIO

BUNATOL 785

Caustic Soda Book

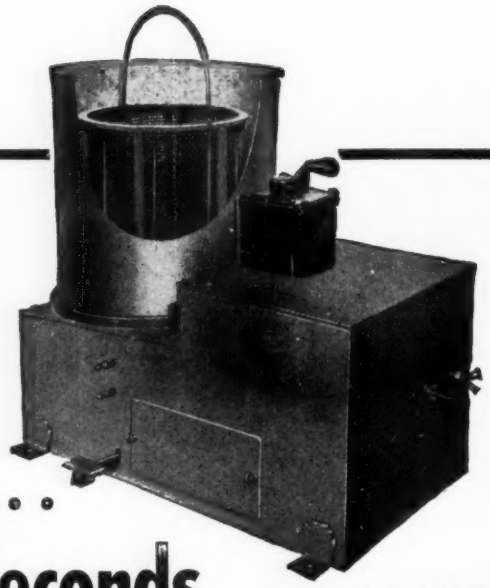
An elaborate 72 page text has recently been released, designed for use by technical men, buyers and executives interested in the economics of caustic soda; the operations man who is interested in the best procedures for unloading, handling and storing this chemical: the engineer who must design equipment and the student or layman who desires useful data on the characteristics, uses, forms, transportation, constants, etc., of caustic soda. The book is printed in three colors throughout and contains many useful graphs, charts and diagrams as well as being profusely illustrated with descriptive photographs.

Write for a copy on your company letterhead to *Pittsburgh Plate Glass Company*, Dept. MF, Columbia Chemical Division, Fifth Avenue at Bellefield, Pittsburgh 13, Penn., for Form A-100.

Precious Metals Plating

A new booklet recently compiled by *A. Robinson & Son* explains precious metal plating, equipment required, solution installation and maintenance, and intrinsic value of various precious metal deposits.

Thoroughly covered in this attrac-



Only...

35 Seconds ... AND A BASKETFUL

OF SMALL PARTS IS COMPLETELY DRY!

That's the success story of the famed KREIDER CENTRIFUGAL DRYER. Place a basket of small parts in the machine ... turn the switch ... in only 35 seconds the job is done! All parts are completely dry and with improved surface lustre for the centrifugal force permits uniform drying that "saves the surface." This is the easily controlled method of drying plated parts, lowering your production time and costs.

It's FREE!...

Fully illustrated bulletin showing Dryer in use and giving complete specifications. Write for it today.

DELLINGER

MANUFACTURING COMPANY

729 N. Prince Street · Lancaster, Pa.

Approved Choice

THE ABBOTT BALL COMPANY HARTFORD, CONN. U.S.A.

tively arranged booklet are electrical equipment, tanks and heating equipment, methods of heating, preliminary cleaning, electrocleaning, pickling and bright dipping, racking and wiring, electroplating rinsing and drying. The plating cycle for gold and rhodium plating is clearly explained, giving operating conditions and other necessary data to maintain these baths.

To obtain a copy of this informative booklet, write A. Robinson & Son, Dept. MF, 131 Canal St., New York 2, N. Y.

Dust Collection Information

By popular demand, *Whiting Corporation*, Dept. MF, Harvey, Ill., has recently published an enlarged and completely revised edition of the bulletin formerly known as "Practical Pointers on Dust Suppression."

This new booklet containing 16, 8½" x 11" pages, and known as "Practical Information on Dust Collection" (*Bulletin FY-142*) covers both general and technical aspects of the subject. Hoods, orifice loss, pipe resistance, fans, air pressures and many other pertinent subjects are discussed in detail. Twenty-eight illustrations, charts, and tables are included for quick reference. To show how sizes and velocities are figured, a typical problem is set up and then solved and discussed in a question and answer method.

Copies of this bulletin will be sent free, upon request.

Simplified Pricing Schedule

Chicago Wheel & Mfg. Co. have adopted a new quantity pricing system on their grinding wheels, identical to the system which they have employed for many years on mounted wheels, incorporating many advantages over the old, cumbersome schedule of discounts.

Now anyone can find the price on a grinding wheel, or other abrasive products without a great deal of calculation and the need of a slide rule.

This new system of pricing Chicago wheels has been heartily endorsed by purchasing agents who have seen it. A copy of this new schedule, making it easy to select and order the exact wheels for any job, will be sent on request to Chicago Wheel & Manufacturing Company, Dept. MF, 1101 W. Monroe St., Chicago 7, Ill.

Industrial Rubber Gloves

Featured by a page of illustrated suggestions on how to get the maximum service from acid and industrial rubber gloves, *The B. F. Goodrich Co.*, Dept. MF, Akron, Ohio, has just published a new catalog section on these products, which can be obtained upon request. The gloves are made by the Anode process directly from liquid latex.

Each glove in the line is described, size, length and thickness listed. The catalog section also covers the company's plastic-treated and plastic-sheet type industrial aprons.

Protective Coatings

A new catalogue giving information on their corrosion resistant coatings has recently been released by the *Prufcoat Laboratories, Incorporated.*

Applications of the film formed after polymerization are given as well as a list of chemicals to which it is said to be resistant in dry heat up to 300 degrees F. and liquid heat up to 180 degrees F. Among the items given are alcohols, cyanides, flue gases, hydrofluoric acid, muriatic acid, nitric acid, tri-sodium phosphate. Application directions are also given; all surfaces must be clean and dry and the coating may be applied by brush or spray; the material may be air-dried, force-dried or baked.

To obtain a copy of this profusely illustrated catalogue folder, write Prufcoat Laboratories, Incorporated, Dept. MF, 63 Main St., Cambridge 42, Mass.

Metal Cleaning Compounds

An attractive four page pamphlet explaining their metal cleaning materials was recently made available by *The Udylite Corporation.*

Thoroughly explained are *Anodex* for reverse current electrocleaning applications; *Dyclene "E"* reverse current electrocleaner for zinc base diecastings; *Metalex "W" Special*, a general purpose cleaner; *Metex* burnishing compounds and soak cleaners; *Rocheltex*, an addition agent for cyanide copper plating solutions to act as a brightener and to improve throwing power; *Durodex*, a reverse current cleaner for steel and copper; *Solvmax* water emulsion spray cleaners; Metex acid additives for use as a liquid wetting agent and mild inhibitor for acid solutions and pressure spray cleaners.

Write The Udylite Corporation, Dept. MF, Detroit 11, Mich.

CHROMIC ACID

99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and over a hundred years of technical background, Mutual is the world's foremost manufacturer of Chromic Acid.

MUTUAL CHEMICAL CO. OF AMERICA — OVER A CENTURY OF CHROMIUM CHEMICAL PROGRESS

Bichromate of Soda
Bichromate of Potash

MUTUAL CHEMICAL COMPANY OF AMERICA
270 MADISON AVENUE NEW YORK 16, N.Y.

PERMAG

PERMAG Cleaning Compounds have been used by the Metal Finishing Industry for more than 20 years. They have stood every test and are in wider demand than ever. Let us send you more details.

Eliminates the Extra Operation!

PERMAG Burnishing and Tumbling Compounds CLEAN and BRIGHTEN in ONE Operation.

No hand polishing or buffing necessary when PERMAG is used on Brass, Steel, Aluminum, etc.

PERMAG cleans thoroughly and produces a high finish on metals. On small steel parts, cleaning time is shortened and the tumbling compound brightens effectively, saving time and labor costs.

Magnuson Products Corp.
Mfrs. Specialized Cleaning Compounds
50 COURT ST., BROOKLYN 2, N. Y.
Nationally Represented
In Canada:
Canadian PERMAG Products Ltd.
Montreal—Toronto

Belke Manufacturing Company display at the Chicago Production Show. Solu-Bridge Controllers, Insulated Plating Racks, Plating Barrels, Rheostats, General Electric Rectifiers, Chandeysson Generators, Permanent Tank Magnets, etc., were on display. Left to right: Harvie Johnson, Wm. E. Belke, Roy Johnson. Back row: Edward Stanek.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

New York Branch

The annual Educational Session and Banquet of the *New York Branch* of the *American Electroplaters' Society* was held Saturday, April 19, 1947 at the Hotel Pennsylvania.

A series of most interesting talks was arranged by *Mr. E. Rinker*, librarian. *Walter H. Prine* of the *International Nickel Co.*, spoke on the finishing of zinc die castings, covering the copper-nickel-chrome cycle and the most effective methods for its use; *Dr. H. Bandes, Sylvania Electric Products, Inc.*, explained practical aspects of polarization in the plating bath; and *Harold Narcus, Electrochemical Industries, Inc.*, gave an instructive talk on plastic metallizing, covering the various processes in use.

In the evening, entertainment and dancing were part of the banquet program, arranged by *Mr. Milton Nadel*.

PREFABRICATED PLATING PLANTS!

★ BUILT-IN GAS, WATER, DRAIN, EXHAUST, AND ELECTRICAL LINES.
★ STANDARD MODELS FOR ALL TYPES OF PLATING, AT VARIOUS CAPACITIES.
★ CUSTOM-BUILT UNITS FOR YOUR PARTICULAR NEEDS, AT NO EXTRA COST.

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BRONZE	CADMIUM
CHROMIUM	COBALT
COPPER	GOLD
IRON	LEAD
NICKEL	PALLADIUM
RHODIUM	SILVER
TIN	ZINC

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ELECTROFORMING
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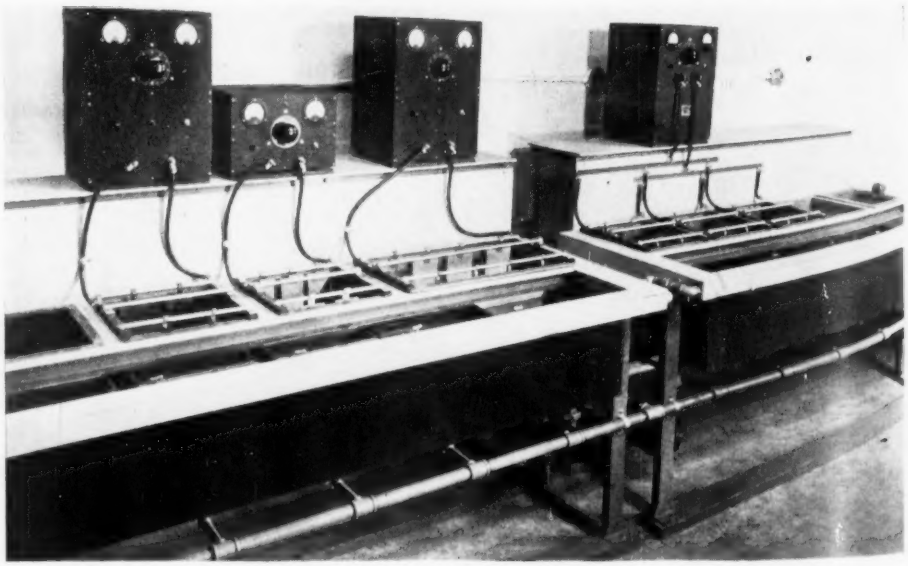
PRODUCTION PLANTS
PILOT PLANTS; LAB. UNITS



ASSEMBLE YOUR PACKAGED PLATING PLANT WITH A SCREWDRIVER AND WRENCH!

UNIT PROCESS ASSEMBLIES, INC.

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About 400 members and guests attended the festivities in the Roof Garden of the Pennsylvania.

Twin City Branch

The *Twin City Branch* of the *American Electroplaters' Society* met Monday, April 7th, 1947, at 7:00 P.M. at the Covered Wagon, in Minneapolis. There were fifty persons present.

The first matter of business was the introduction of guests. They were *Messrs. Jack Harris*, Aluminum Company of America, *Dwight Frick*, Gray Company, *Robert Berg*, Minneapolis Honeywell, *Stan Liden* of Minneapolis Honeywell, *Rueben Ostrom*, Hawkins Chemical, *Don Schwarz*, *Jack Rick*, *Lowell Rutherford*, *Gene Jorgenson* and *Wray Shore* all of Hiawatha Metalcraft and *C. J. Hinton* of Alcoa. *Mr. A. T. Leonard*, membership chairman, introduced *Mr. Dana L. Wobschall* of E. F. Johnson Company, Waseca, Minnesota, a new member in the branch.

President Lillicrop named the following members to the auditing committee: *Messrs N. A. Glenn*, chairman, *Frank Nelson*, and *E. W. Presser*.

The nominating committee reported on their state of officers for consideration. They were: *A. T. Leonard* for president, *R. M. Krieger* for 1st vice president, *Dick Venier* for 2nd vice president, and *Robert L. Buckley* for secretary-treasurer. Elections will be held at the May meeting.

The Secretary read a letter from the *Milwaukee Branch* extending an invitation to their Annual meeting to be held April 26th, 1947.

President Lillicrop announced that tickets for the Third Annual Party of the Twin City Branch would be available at the May meeting with more data given at that time. The party will be June 5th, 1947.

Following the business session, the meeting was turned over to *Dr. Frank Ireland*, branch librarian, who introduced *Mr. Ralph Pettit* of the Aluminum Company of America. Mr. Pettit spoke on "Finishes for Aluminum," and showed movies on this subject. The program was very interesting and informative.

Baltimore-Washington Branch

The March meeting of the *Baltimore-Washington Branch* of the *American Electroplaters' Society*, which was held in Baltimore, had the

McKeon's
Tin-Strip
TRADE MARK REG. U.S. PAT. OFF.

NON ETCHING
NO CURRENT REQUIRED
FAST IN ACTION
EASY TO USE

The modern, efficient and economical product for stripping tin without damage to base metal!

Sold unconditionally Guaranteed on thirty days approval.

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GREENSBURG, PENNSYLVANIA

BOOTH 110—AES CONVENTION—DETROIT—JUNE 23-27

HARRISON 4A PRODUCTS

Uniform, Quality Compounds for
BUFFING and POLISHING

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Double Header Compounds in
Sizes—150 - 180 - 220 - 240 & 320

HARRISON & COMPANY, INC.
HAVERHILL MASSACHUSETTS

pleasure of hearing two interesting papers. *Thomas F. Kearns*, a materials engineer of the Navy Department's Bureau of Aeronautics, presented a paper on the "Deposition of Non-Metallic Coatings on Metals." In his paper he reviewed the principles and methods of depositing non-metallic coatings, such as rubber, beeswax, resins, and graphite, on metals. From his paper it became evident there is plenty of rom for improving existing methods of protecting metal against corrosion. In fact electroplaters would do well to watch these new developments so that their shops can give their customers the latest and best possible service.

The members were given a thrill when *Irving Corte*, a chemist at the Army Medical Center at Walter Reed Hospital, Washington, D.C., who delivered a paper on "Electroforming of Molds for Cosmetic Gloves from Flexible Positives," when he tossed out to the members two almost unbelievably realistic flexible plastic gloves which looked like human hands, showing blood vessels and small hairs. The members were also given an opportunity to critically examine electroplated glove molds, (developed at the National Bureau of Standards under the direction of *Dr. William Blum*). Mr. Corte spoke of the difficulties which had to be overcome in developing electroplated molds; and he described the present methods of plating the molds with silver, copper, and nickel.

At the business session of the meeting *Dr. Abner Brenner*, president of the Branch, announced the appointment of *Dr. Vernon A. Lamb*, *Charles W. Ostrander*, and *Carroll T. Thomas* as members of the nominating committee for the selection of two sets of candidates for next year's officers. *Maurice Kaplan* of Baltimore was appointed chairman of Branch's Exhibition Committee for the annual meeting of the American Electroplaters' Society. After announcing these appointments Dr. Brenner asked *Thomas Slattery* to give a ten minute talk on the proposed changes of the Society's constitution. Before turning the meeting over to Dr. William Blum, who acted as chairman of the educational session, Dr. Brenner announced that *Gustaf Soderberg* would address the members of the Branch at their April meeting which will be held in Washington.

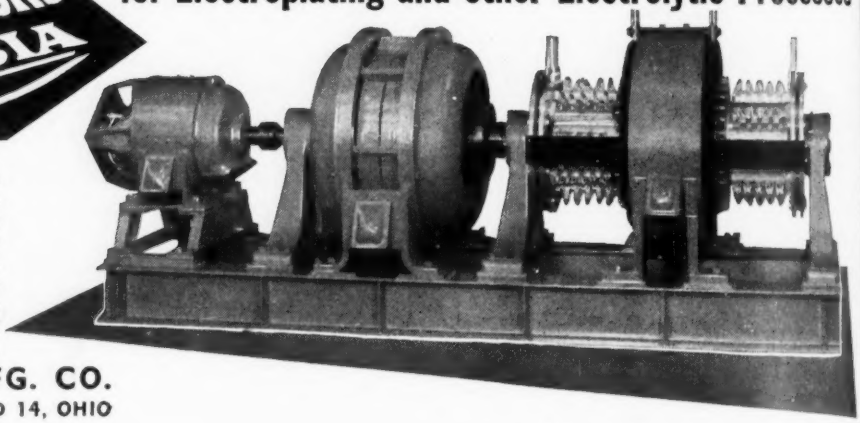
Los Angeles Branch

Howard Woodward, sales and service engineer of the *Sundmark Supply Company*, was elected president of *Los Angeles Branch* of the *American Electroplaters' Society* at the April 14 meeting held in the Elks Club.

Frank Bunker, *L. H. Butcher Company*, was elected first vice-president; *Allie Sulzinger*, *Hughes Aircraft Company*, second vice-president; *George Kent*, *Kent Laboratories*, treasurer; *Gene Williams*, *L. H. Butcher Company*, secretary; and *John Millhorn*, *Mefford Chemical Company*, librarian.

MOTOR GENERATORS by COLUMBIA

for Electroplating and other Electrolytic Processes



Columbia Generators embody every feature essential for dependable, 24-hour operation. They are built for electroplating service in sizes of 6 to 20 volts, 500 to 20,000 amperes, for anodic treatment of aluminum in sizes of 40, 50, and 60 volts, 500 to 3,000 amperes. Columbia Generators for other electrolytic processes range from ½ to 250 KW, 100 to 40,000 amperes, 6 to 60 volts. Write for full information.

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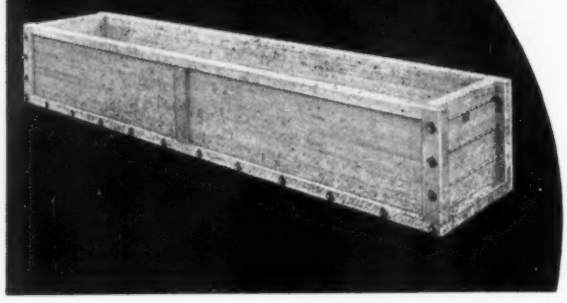

Excellent service on all types of Wood Tanks.

The shortage of metals has increased the demand for wood tanks for plating and pickling service. We can give excellent service on all types of tanks. Send us your inquiries.

Kalamazoo TANK & SILO CO.
KALAMAZOO - MICHIGAN

The separation of the secretary-treasurer post into two offices represented a departure from previous administrative procedure of the branch, the two offices having heretofore been filled by one man. *Earl Coffin* pointed out, however, that the correspondence and other secretarial duties alone were quite a burden and that collection of dues and handling of financial matters could well be delegated to another officer. A motion to relieve the secretary of financial work and create a separate treasurer post was unanimously approved.

Retiring president *D. N. Eldred*, retiring secretary-treasurer *Emmette R. Holman* and Mr. Coffin were named to the board of managers, with Mr. Eldred as chairman.

Four new members were initiated and the applications of four others approved. These latter included *Thomas A. Foster* and *John R. Mergell* of *Latex Dipped Products Company*, and *Louis C. Shoals* and *M. Goldman* of *Latex Seamless Products Company*.

As chairman of a committee appointed at the March meeting to submit a recommendation on the proposed revisions in the Supreme Society constitution, Mr. Coffin requested that the committee be given another month for more thorough consideration of the problem. The request was granted.

The financial report presented by Mr. Holman disclosed that a comfortable margin of profit was realized on the annual educational session and dinner dance held March 22 in the Los Angeles Breakfast Club.

Guests present at the April meeting included *Stuart Krentel* of Chicago Branch, *Arnold Delrot* of the L. H. Butcher Company, and *James M. Carter*.

The speaker was *Morton Schwartz* of the Sundmark Supply Company's engineering staff, formerly electrochemist with the *Standard Steel and Spring Company*, Pittsburgh, Pa. He gave an extemporaneous talk on plating all-steel bumper bars, describing techniques employed in plating bumper bars in the Pittsburgh and Correopolis, Ohio, plants of the Standard Company.

Chicago Branch

The regular meeting of the *Chicago Branch* of the *American Electroplaters' Society* was held on March 14, 1947 at the Atlantic Hotel.

BRILLIANT LUSTROUS DEPOSITS WITHOUT COLOR BUFFING ... AN IDEAL BASE FOR CHROMIUM

NEW IMPROVED

Lustrebright

Bright Nickel Process

Produces Brilliant, Lustrous, Adherent Nickel Deposits • Elminates Color Buffing — Re-Cleaning — Re-Racking • An Ideal Base for Chromium • Excellent Throwing Power • No Special Solutions or Changes in Equipment Required • Easy to Control • Low in Cost • Successful • Practical.

Gives uniform results and continuous operation on all classes of work in still tanks and mechanical barrels. Substantially reduces plating costs. Brilliant, lustrous, nickel deposits that may be chromium plated, are produced by merely adding NEW IMPROVED LUSTREBRIGHT to your present cold nickel solution, if of standard formula.

Work comes from plating tanks with bright, fine grained, adherent deposits. No color buffing or burnishing is required. Work may be transferred direct from nickel to chromium bath, without intermediary buffing, re-cleaning, or re-racking. Excellent for zinc die-castings.

GUARANTEED NOT TO HARM PLATING SOLUTION. Will not cause plate to peel, become brittle, or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of NEW IMPROVED LUSTREBRIGHT. Write for complete information.

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CHROMIUM
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Simple test sets for controlling these and other solutions available.

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Specify Kocour Sets from your supplier.

Instead of the usual technical session, one of the members, *Mr. Ernest H. Lyons* of the *Meaker Company*, showed moving pictures which he had taken on a trip into Utah. He had made an extensive pack trip on horseback through some recently opened country and his scenic shots made a good many of the assembled members quite dissatisfied with Chicago; however, since he did not run across a single plating shop in three weeks, the question was raised as to what a displaced plater would live on. No satisfactory answer was returned to this question.

The question box was well loaded and some interesting discussions ensued.

Ladies were also present as guests and in addition refreshments were served after the meeting.

Buffalo Branch

One hundred and ninety-six members and friends attended the Annual Educational Session and Dinner Dance sponsored by the *Buffalo Branch* of the *American Electroplaters' Society* at the Hotel Markeen, March 22, 1947.

The afternoon session started at 2:30 p. m. *Mr. Charles Logan*, the chairman, introduced the guest speaker of the day, *Mr. Ralph E. Pettit* of the *Aluminum Company of America*. Mr. Pettit gave a very interesting talk on the Finishing of Aluminum, followed by moving pictures. An excellent display of Aluminum in various finishes was on display.

The ladies indulged in playing cards in the afternoon. Dinner was served at 7:30 p.m. and after dinner many beautiful door prizes were given out, thanks to the many friends who donated the gifts.

Mr. and Mrs. Burt Kirchoff of the Buffalo Branch won the Waltz Contest, the prize being two bottles of champagne.

Several members from the following branches were present: Rochester, Toronto, Syracuse annd Cleveland.

The regular monthly meeting was held Friday, March 14, 1947 at the Hotel Statler. *Dr. C. J. Werlund*, vice-president, called the meeting to order at 8:15 p.m.

The minutes of the previous meeting were approved as read. The treasurer's report was read, and a motion was made and seconded that expenses be paid and the report be accepted.

A motion was made and seconded that the delegates who are elected for the coming convention, which will be held in Detroit in June, should be instructed to vote no to the proposed Constitution change.

A motion was made and seconded that the Buffalo Branch would not submit a display board for the Exhibition in the Convention Hall at the coming Convention.

Mr. C. Logan, librarian, introduced the guest speaker of the evening, *Mr. W. H. Jackson* of the *Udylite Corporation*, Detroit, Mich. Mr. Jackson gave a very interesting lecture on "Horizontal Plating Barrels and Auxiliary Equipment," along with some prints showing various shop layouts of barrel plating equipment. A chart was placed on the wall and Mr. Jackson explained the necessary amount of amperes required with different plating solutions to acquire a certain thickness of plate. Many questions were asked by the members which were promptly answered by Mr. Jackson.

COMFORTABLE HAND PROTECTION
WHEN THE GOING'S ROUGH!
Edmont palm coated gloves give extra protection where hands are subjected to rough, abrasive materials. Rubber bonded to fabric on all wearing surfaces makes them tough, wear and tear resistant—canvas back permits ventilation. Comfortable as a cotton glove but many times the wear.
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VAPOR DEGREASERS
MAKE METAL CLEANING
Easier • Faster
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● Metal parts and assemblies completely and safely cleaned of oil, grease and contamination in 1 to 5 minutes.
● Patented self-distilling feature reclaims up to 75% of the used solvent
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● No installation problem—just plug in—all electric—entirely automatic
Let us solve your problems with "Phillsolv," the least toxic, most efficient and economical vapor degreasing solvent on the market.
Write for handbook on "Vapor Degreasers"—there's a Phillips degreaser for every metal cleaning need.
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AMERICAN SOCIETY FOR TESTING MATERIALS

New officers were elected by *Committee B-8 on Electrodeposited Metallic Coatings* at the meeting on February 28 during A.S.T.M. Committee Week in Philadelphia. *C. H. Sample* who had been the secretary was elected to fill the unexpired term of *R. J. McKay* who resigned as chairman, while *R. B. Saltonstall* will be Secretary. New officers of most of the subcommittees were also selected so that the present subcommittees and their officers are as follows:

Sub. I. Specifications, Papers and Definitions, *J. E. Stareck,* Chmn.

Sub. II. Performance Tests, *H. A. Pray,* Chmn., *F. R. Keller,* Sec.

Sub. III. Conformance Tests, *W. A. Wesley,* Chmn.

Sect. 1. Thickness, *A. H. DuRose,* Chmn.

Sect. 2. Porosity, *A. Mendizza,* Chmn.

Sect. 3. Adhesion, Hardness and Ductility, *E. J. Roehl,* Chmn.

Sub. IV. Electroplating Practice, *F. K. Savage,* Chmn., *M. B. Diggin,* Vice-Chmn., and *K. M. Huston,* Sec.

Sub. V. Supplementary Protective Finishes for Metallic Coatings, *Marc Darrin,* Chmn.

Subcommittee I reviewed its work on definitions and reviewed papers by *K. G. Soderberg, W. A. Wesley* and *H. A. Pray* on methods of rating different types of exposure test panels. These papers are to be presented at a Symposium on the subject sponsored by the Committee B-8 at the ASTM Atlantic City Meeting in June. Subcommittee II reviewed its program of exposure tests of lead and copper-nickel-chromium coatings on steel and reported on the results to date. Subcommittee III organized three new sections noted above. These sections will work in close cooperation with Project Directing Subcommittees of the *American Electroplaters' Society* Research Committees on the same subjects.

Subcommittee IV reported that it had substantially completed a recommended practice for preparing high-carbon steel for plating (to be submitted to letter ballot action prior to the next meeting) and also reported plans for a similar recommended practice for preparing zinc-base die castings for plating. Subcommittee V reported that it was formulating plans to evaluate the protective value of supplementary protective treatments on electro-deposited coatings and planned to submit a proposed program at the next meeting.

Letter to the Editor

Metal Finishing
11 W. 42nd Street,
New York, N. Y.
Dear Sir:

I wish to add my expressions of admiration and commendation at the variety and scope of electroplating activities at the U. S. Naval Gun Factory, Washington, D. C., as described in an article in the November, 1946, *Metal Finishing*. Even to one who has been connected with the electroplating of torpedo air flasks, the magnitude of operations at the Gun Factory is arresting.

However, it was with some surprise

BLU-BLAK

America's Lynx Line Supreme

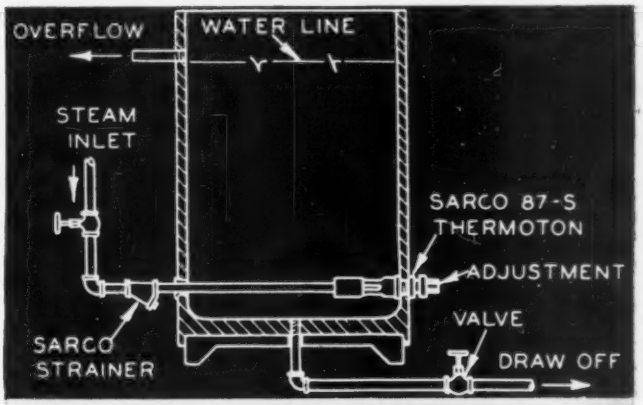
METAL BLACKING PROCESS

Manufacturers with metal finishing departments and independent metal finishing job shops will be vitally interested in this announcement concerning BLU-BLAK, the most remarkable metal-blacking process ever offered for industrial use. BLU-BLAK was originally developed and perfected for the firearms field and so amazing has been its ability to meet the most exacting gun-bluing requirements of this very precise industry, that its benefits are now being made available to you.

Let us quote you on your production requirements. Meanwhile run a trial test. Learn for yourself in your own plant or laboratory just what BLU-BLAK can do for you. Send in your order today for the $15.00 35 lb. BLU-BLAK TEST UNIT sufficient to make 4½ gallons of solution.

H. TOM COLLORD—*President*

PROTECTIVE COATINGS INC.
BOX 3985, DETROIT 27, MICHIGAN



LOW COST TEMPERATURE CONTROL

Wrong temperatures in washing operations can ruin more work than the process operations themselves. Right temperatures can be obtained on every tank in your plant with the Sarco 87S trap control. It is simple, reliable, inexpensive and easy to install.

A steam injector with temperature control built in. Other types used extensively on steam coils in tanks or kettles. Combine a steam trap and temperature control at small cost. Bulletin 550.

194

SARCO SAVES STEAM

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that I read in paragraph 3 of the subject article that "Other electroplating plants (chromium) have since (1928) been installed in other Naval activities from plans, instructions and specifications furnished by the Naval Gun Factory." I disagree emphatically with this statement. In 1930-1931, a chromium plating unit was installed in the Plating Department of the U. S. Naval Torpedo Station, Newport, R. I., entirely from plans, specifications and instructions furnished by myself. The subsequent success of this chromium plating unit, due largely to the skill and ingenuity of platers *James Radcliffe* and *Peter Bonchard*, is attested to by the Naval Service.

I also question the statement in paragraph 2 of the same article that "a new process of lead-tin alloy plating was developed." The process of lead-tin plating as described in the article was developed at the U. S. Naval Torpedo Station, Newport, R. I., by the Chemical Laboratory of that facility.

Yours truly,
A. Mankowich

News from California

By Fred A. Herr

New Detrex West Coast Solvent Supply

An entirely new source of supply for its *Perm-A-Clor* and *Triad* metal degreasing solvents is announced by *Detrex Corporation* through *W. W. Davidson*, vice president in charge of Sales.

A new chemical manufacturing plant, located on the Pacific Coast, is starting its initial flow of degreasing solvents to the Western manufacturing plants. The entire output of this plant will be devoted to non-flammable, stabilized, chlorinated hydrocarbons, for high-speed, thorough cleaning at low cost both in the metal and dry-cleaning industries.

This new plant is close to raw materials and the rapidly expanding manufacturing areas on the coast. These industries will now be more efficiently and quickly served than has been possible in the past.

Offices and warehouses, distributing these solvents are located in Los Angeles and San Francisco, California; Portland, Oregon and Seattle, Washington, under the management of *S. B. Crooks*. A staff of competent, experienced field representatives is maintained for consultation and service on any cleaning problem.

The *Metal Finishers Association of Southern California* elected the following new 1947 officers at its recent meeting in Los Angeles: president *Earl Coffin* of the *Palace Plating Works*, Los Angeles; vice-president *Harold Coombs*, *Crown City Plating Co.*, Pasadena; secretary-treasurer *Marcus D. Rynkofs*, *Liberty Plating Co.*, Los Angeles.

Membership in the association, which in April numbered 30, is confined to job plating shop owners. *S. Smith* is executive manager with headquarters at 2714 So. Hill St., Los Angeles. The association meets the third Tuesday of each month.

PLATING RECTIFIERS

- Hermetically Sealed Voltmeter and Ammeter
- Corrosion and Oxidation-proof Solderless Lug-type Connections
- Complete Overload Protection
- Immediate Delivery on 3 Standard Models
- Double Output* and Special Models to Order

SELENIUM

Model 5510, Illustrated, $140.

STANDARD MODELS

Model #5510	0-10 Volts	50 Amps.
Model #1110	0-10 Volts	100 Amps.
Model #2239	0- 9 Volts	150 Amps.

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2849 Middletown Rd., Bronx 61, N. Y.

Quality Chemicals for over 50 years

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COPPER SULPHATE
NICKEL SULPHATE
COPPER OXIDE

One of the most comprehensive precious metal plating establishments is taking shape at 213 So. Glendale Ave., Glendale, where *A. H. Dibbern* of *Dibbern's Jewelers and Silversmiths* has construction underway on a new 30 x 60 foot building. The rear will house Mr. Dibbern's new precious metal plating and polishing plant and facilities for handling one of his specialties—antique silverware. The former shop building is being converted into a chrome and nickel plant, for which tanks were on order in April. Stores in the front part of the new building will be leased to a jewelry retailer and repairer, watchmaker, engraver and silversmith, in conformance with Mr. Dibbern's idea to make any activity dealing with jewelry or precious metal processing convenient to a customer in one central location.

Fire on April 3 destroyed two of the four buildings of the *Farrar Industrial Products Co.*, 6715 S. McKinley Ave., Los Angeles, causing $175,000 damage. The firm manufactures soap, cleansers, lubricants, corrosive products, oils and greases, including a cleaner for the plating trade.

Repcall Brass Mfg. Co., Los Angeles, has completed installation of a $25,000 full-automatic nickel and chrome machine for use in processing plumbing goods which, according to *Harold Shepard*, superintendent of the firm's engineering and metal finishing department, is the fourth largest setup in the country.

The unit, Shepard reported, can handle a maximum of 7,000 pieces an hour, consisting of such items as faucets, bonnet nuts, sinks and other plumbing parts and fixtures.

Coincident with the recent completion of Repcall's new $50,000 plant addition, the firm also installed a new automatic buffing machine involving an outlay of some $10,000. Both units are set up in the new 45 x 76 addition, which houses the various metal finishing departments on the lower floor, and a laboratory and storage areas on the second floor.

Louis B. Hart has been named West Coast sales manager for *Ferro Enamel Corporation* of Cleveland, O., with headquarters in the firm's new plant at 5309 South District Boulevard, Los Angeles.

Hart served as service representative for the company from 1924 to 1935, as director of field service from 1935 to 1943, and as manager of the *Frit Division* from 1943 until his recent appointment as west coast sales-manager. The new Los Angeles plant, in addition to manufacturing frits, glazes and colors, will warehouse other Ferro products and serve also as headquarters for engineering services for furnaces, kilns and equipment. *J. A. Rumor* is plant manager.

Arnold Delrot, who for the past six years was plating division foreman in the *Cadillac Motor Company's* Detroit plant, has joined the staff of the *L. H. Butcher Co.* at Los Angeles.

Burton Russell, formerly salesmanager for *Exeter Oil Company*, was in mid-April appointed manager of the *Cee-Bee Chemical Company, Inc.*, Los Angeles, manufacturer of specialized industrial cleaning compounds.

Joseph F. Hart, formerly technical director, has been promoted to manager of sales and engineering, a newly created department to provide field technical assistance to clients. Hart

FELT WHEELS
Superior for
POLISHING
and
FINISHING

"FELT DOES IT BETTER"... FELT may be best for polishing and finishing your products. FELT WHEELS have a combination of density, resiliency and adaptability that means higher finishes and longer wheel life! In the long run you cut costs by using FELT. Why not make a thorough test and check this for yourself? Besides, felt is available. There's no shortage.

When you order FELT WHEELS specify PARAMOUNT BRAND FELT WHEELS for top quality and uniformity.

BACON FELT COMPANY
Established 1824
Winchester Massachusetts
"America's Oldest Felt Manufacturer"

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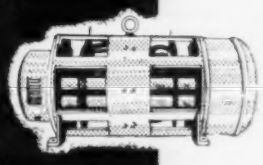
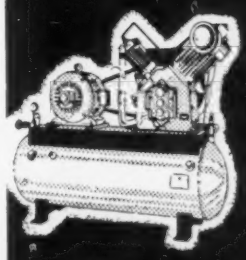
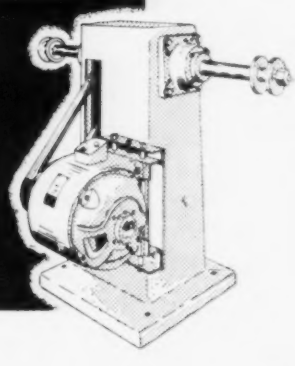
DEPENDABLE...
ELECTROPLATING AND FINISHING EQUIPMENT AND SUPPLIES

Motor Generator Sets, Plating Rheostats, Tanks for all purposes, Plating Barrels, Agitators, and practically everything for the Plating Department.





Air Compressor Units, Baking Ovens, Spray Booths, Fans, Transformers, Regulators, Pressure Tanks, and practically everything for the Spray Department.



Motor Driven Buffing Lathes, Hoods, Blowers, Ducts, Blower Systems, Floor Lathes, Scratch Brush Units and practically everything for the Buffing Department.

formerly was chief chemist for *Kelite Products, Inc.*, and prior to that served as testing engineer for the U. S. Bureau of Standards. He was succeeded as technical engineer for the Cee-Bee Co. by *Keith Whitcomb*, a research chemist formerly with *Ryan Aeronautical Corporation*, San Diego, and during the war, chief chemist at the Marine Air Corps station, El Toro, Calif.

Morton Schwartz, formerly electrochemist in the Pittsburgh, Pa., plant of the *Standard Steel Spring Company*, has joined the engineering staff of the *Sundmark Supply Company*, *Roger Sundmark*, president, announced in April. Schwartz, a member of Pittsburgh Branch, AES, has indicated he will transfer membership to Los Angeles branch.

A visitor to Southern California in April was *Stuart Krentel*, who formerly was with the *Arrow Plating Company*, 1815 W. Lake St., Chicago. He was quite active in the affairs of Chicago AES Branch, most recently as assistant to *Branch Secretary Marion Longfield*. Krentel said he was in Los Angeles on a "sort of looking around" visit, and may increase the city's permanent population by one if the right business opportunity presents itself.

Plans for construction of a new plating shop building costing some $8,000 exclusive of equipment, at 694 Robertson Blvd., Los Angeles, have been announced by *W. C. MacDonald*.

New Incorporations

New incorporations in California during the past month include the following:

Non-Corrosive Products Co., Inc., Los Angeles, capital stock, $50,000, established for the manufacture of protective coatings under the trade name of *Protectakote*. Associated in the new firm are *A. Walter Seymour* of Vista, Calif., and *Edward W.* and *E. E. Seymour*, Sherman Oaks.

Aluminum Folding Crutch Co., Inc., Los Angeles, capital stock $75,000, for the manufacture of general metals, machinery and supply business. Directors are *C. R. Cohen* and *M. E. Umberger* of Los Angeles, and *M. B. Levisse* of Alhambra, Calif.

Aurora Welding & Tank Works, Stockton, Calif., established with a capital of $100,000 for the manufacture, fabrication and repairing of all kinds of metal products. Directors are *Robert G.*, *G. M.* and *B. J. Hanson*, all of Stockton.

New Construction

American Manganese Steel Co.: permit issued for construction of 40 x 100 foot foundry addition costing $16,000 at 5805 Downey Road, Los Angeles.

Precision Plating Co.: erection underway on new one-story plating shop building at 942 E. 108th St., Los Angeles.

American Radiator & Standard Sanitary Corp. of Pittsburgh, Pa.: working drawings being prepared for construction of $950,000 brass manufacturing plant of 200,000 square feet floor area adjacent to company's Pritchard Street plant in Richmond, Calif.

Smith-Davis Paint Co.: plans announced for construction of $40,000 paint factory of 7250 square feet floor area at 10571 Venice Blvd, Los Angeles.

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Obituary

Benjamin Popper Succumbs

It is with deep regret that the death of *Benjamin Popper* on April 11, 1947 is announced. Mr. Popper had been ill for several months.

Mr. Popper, an honorary member of the *New York Branch* of the *American Electroplaters' Society*, started his career with the *Egyptian Lacquer Mfg. Company*. His membership in the A.E.S. dates back over 30 years and he was one of the first lacquer salesmen elected to the society.

Benjamin Popper

"Ben," as he was affectionately known to his many friends, began his business career with the same lacquer firm in July, 1901 as an office boy. In 1904, his ambition to become a salesman was realized and he was given a territory in New York City where he worked continuously ever since.

In June, 1941 a surprise testimonial dinner was given for him by the New York Branch of the A. E. S. A scroll, printed in gold, was given to Mr. Popper to signify the occasion and was signed by the 126 people in attendance.

Mr. Popper's passing will be keenly felt by his many friends throughout the country.

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